U.S. Robotics®

COURIER 2400™ MODEM

2400/1200/300 BPS, AUTO DIAL, AUTO ANSWER MODEM
FOR DATA COMMUNICATIONS

USER'S MANUAL

USRobotics®

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FOR DATA COMMUNICATIONS

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LIMITED WARRANTY

U.S. Robotics, Inc., warrants to the original consumer or other end user purchaser that this product is free from defects in materials or workmanship for a period of two years from the date of purchase. During the warranty period, and upon proof of purchase, the product will be repaired or replaced (with the same or similar model) at our option, without charge for either parts or labor. This warranty shall not apply if the product is modified, tampered with, misused, or subjected to abnormal working conditions.

REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY OF THE PURCHASER. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE, AND U.S ROBOTICS SHALL IN NO EVENT BE LIABLE TO PURCHASER FOR INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND OR CHARACTER.

Some states do not allow the exclusion or limitation of incidental or consequential damages or allow limitations on how long an implied warranty lasts, so the above limitations or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

To obtain service under this warranty, contact the U.S. Robotics Technical Support Department at 800/982-5151, (in Illinois, 312/982-5151), or by mail at 8100 North McCormick Blvd., Skokie, Illinois, 60076. You will be given a Return Materials Authorization (RMA) number to help us keep track of your warranty request. Once you have received your RMA number, take or mail the product, postage prepaid, to U.S. Robotics at the above address. Include proof of the date of purchase. IMPORTANT: If you ship your unit, pack it securely, be sure your RMA number is visible on the outside of the package, and ship it charges prepaid and insured.

➤ Should you encounter problems in operating this device, follow the instructions in Appendix D in Part II of this manual. The Appendix contains solutions to operating problems as well as procedures to follow if there is an apparent modem malfunction.

FCC REGISTRATION NUMBERS
FCC68: CJE794–11323–DM–E
RINGER EQUIVALENCE: 0.4B
FCC15: CJE794Courier2400

CONNECTING TO THE TELEPHONE COMPANY

Once your modem is installed, the telephone company may request the following information:

1. The telephone number (or numbers) to which the Courier 2400 is connected.
2. The FCC registration number printed on the bottom of the unit:

   FCC68: CJE794–11323–DM–E

3. The ringer equivalence, 0.4B.

If the telephone company has any questions or raises problems, ask them to call the Technical Support Department, USRobotics, Inc., 800/982-5151 (in Illinois, 312/982-5151).

If the modem is malfunctioning, it may be affecting the telephone lines. In this case, disconnect the modem until the source of the difficulty is traced. Do not use the modem on party or coin telephone lines.

RADIO AND TELEVISION INTERFERENCE

This equipment generates and uses radio frequency energy and if not installed and used properly, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. The Courier 2400 has been tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference in a residential installation.

However, there is no guarantee that interference will not occur in a particular installation. If this device does cause interference to radio or television reception, which you can determine by monitoring reception when the modem is on and off, try to correct the problem with one or more of the following measures.

Reorient the receiving antenna.

Relocate the computer with respect to the receiver.

Relocate the computer and/or the receiver so that they are on separate branch circuits.

If necessary, consult your dealer or an experienced radio/television technician for additional suggestions. You may find the following booklet, prepared by the Federal Communications Commission, helpful:

How to Identify and Resolve Radio-TV Interference Problems
Stock No. 004–000–0345–4
U.S. Government Printing Office
Washington, DC 20402

FOR CANADIAN MODEM USERS

The Canadian Department of Communications (DOC) label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The department does not guarantee the equipment will operate to a user's satisfaction.

Before installing this equipment, make sure you are permitted to connect it to the facilities of the local telecommunications company. You must also install the equipment using an acceptable method of connection. In some cases, you may also extend the company's inside wiring for single line individual service by means of a certified connector assembly (telephone extension cord). You should be aware, however, that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by a user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

For your own protection, make sure that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Do not attempt to make such connections yourself; contact the appropriate electric inspection authority or electrician.

COURIER 2400 MODEM LOAD NUMBER: 33B

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to the telephone loop used by the device, without overloading. The termination on a loop may consist of any combination of devices, subject only to the requirement that the total of the Load Numbers of all the devices not exceed 100. An alphabetic suffix is also specified in the Load Number for the appropriate ringing type (A or B), if applicable. For example, LN = 38B designates a Load Number of 38 and a B-type ringer.

HOW TO USE THIS MANUAL

This manual is divided into two parts. The first part is designed to aid you in getting your modem connected and operating as quickly as possible. The second part contains a number of informative appendixes that you may or may not need, depending on your situation, and a Glossary.

Below is a brief description of the manual's contents. Be sure to follow the set-up and operation instructions in Chapters 2 and 3. We suggest you read all of Part I before operating the modem.

- Chapter 1—Introduction
- Chapter 2—Assembling and testing the modem
- Chapter 3—Automatic dialing and answering, command set usage

The appendixes in Part II cover the following subjects:

- Background information for new users
- Summaries and tables
- Problems, their causes, and solutions
- Additional operational information
- Technical specifications

Whenever a cross-reference is made to the same or a similar subject, you'll be directed to the appropriate section of the manual with this arrowhead symbol, ➤.

CHAPTER 1
INTRODUCTION

The USRobotics Courier 2400 modem is one of the most advanced communications devices in the world. Whether you're a seasoned modem user or have just purchased your first modem, we're sure it will give you excellent service.

Once you've connected the Courier to your computer or terminal and to the telephone line, you'll be able to use your equipment in exciting new ways. Figure 1.1 illustrates only some of the many possibilities.

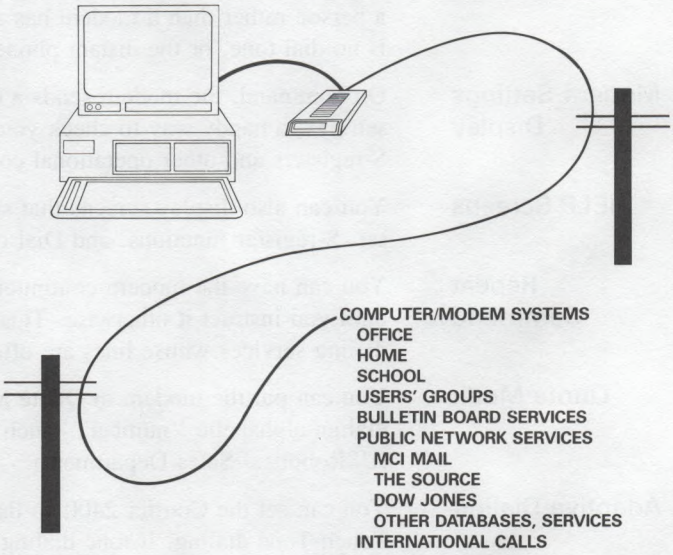

Figure 1.1—Data Communications Options

SPECIAL FEATURES

Your new modem is an intelligent device whose software supports a wide variety of features such as automatic dialing and automatic answering. The Courier 2400 also supports the full "AT" command set that has become the industry standard for modems used in microcomputer communications.

In addition to these standard capabilities, the Courier 2400 offers the following features. Unless otherwise noted, these features are unique to USRobotics' newest line of modems.

Bottom Panel Reference

On the bottom of the Courier case you'll find a command summary and other handy reference information, as well as the bank of Dual In-Line Package (DIP) switches used to tailor operations to your requirements.

Call Duration Reporting

The Courier records the duration of your calls in hours, minutes, and seconds. This feature enables you to display and print an audit of your calling activities. You can optionally use the modem clock as a real-time clock.

Call Progress Detection

As with some other 2400 bps modems, a new set of result codes (screen messages) lets you know when a line is busy, a person rather than a modem has answered the phone, there is no dial tone, or the distant phone is ringing.

Modem Settings Display

On command, the modem sends a display of its current settings, a handy way to check your transmission rate, S-registers and other operational controls.

HELP Screens

You can also display screens that summarize the command set, S-register functions, and Dial command options.

Repeat Command

You can have the modem continuously repeat a command until you instruct it otherwise. This is especially useful in dialing services whose lines are often busy.

Quote Mode

You can put the modem in Quote Mode if you want it to dial an alphabetic "number," such as 800-"DIAL USR" (USRobotics' Sales Department).

Adaptive Dialing

You can set the Courier 2400 so that it automatically uses Touch-Tone dialing. If tone dialing doesn't work on the line, the modem automatically switches to the slower type, pulse (rotary).

Data Rate Fallback

In addition to automatically adjusting to the bit rate of incoming calls (0–300, 1200, 2400 bits per second, or bps), the Courier 2400 incorporates the V.22*bis* fallback recommendation when dialing. If the called modem operates at 1200 bps, the Courier 2400 automatically drops back to 1200 bps. Chapter 3 has more information on fallback operations. "Standards and Compatibility," in Appendix A, describes V.22*bis*.

Automatic Retraining

The Courier 2400 observes the V.22*bis* retrain sequence, which enables modems communicating at 2400 bps to compensate for certain problems that may affect data reliability. Chapter 3 and Appendix F contain more information.

COURIER 2400 COMPATIBILITY

Your modem has the following compatibility features:

- Can be used with any computer or terminal that is compatible with the RS-232C standard interface. (➤ For more information on the RS-232C interface, see Appendix B-1.)
- Can be used with any computer or terminal that uses ASCII, the standard character code supported by most equipment manufacturers.
- Works with TELPAC Telecommunications Software, produced by USRobotics, as well as most other telecommunications software packages.
- Transmits or receives data at speeds of 0–300, 1200, and 2400 bps.
- Is Bell 103- and 212A-compatible, V.22*bis*-compatible, and works on almost any telephone line.
- Is fully FCC-certified for the uses described in this manual.

OPERATIONAL REQUIREMENTS

The Courier 2400 has minimal operational requirements. Be sure to read the information in the front of this manual about radio and television interference and connecting to the phone company. In addition, you should be aware of the following:

- The modem will not work properly on party lines without transmitting random data (''garbage'') when other parties pick up the phone.
- If you want to use digital networks such as Bell's Dataphone Digital Service (DDS), you'll have to purchase an *analog converter*. These are available from your phone dealer.
- If the modem is to be installed on a PBX system, a leased telephone company line, or a dedicated (customer-installed) line, you'll need to follow the operating instructions in Appendix E-4.
- If you're working with a computer rather than a terminal, the computer must be in *Terminal Mode*. If you're a new modem user and unfamiliar with this requirement, you'll find the information in Appendix A helpful.

- You'll need an RS-232C cable to connect the modem to your computer or terminal. Use a *shielded cable* to ensure minimal interference with radio and television reception. (➤ For information on the RS-232C interface, see Appendix B-1.)

  In most situations, the RS-232C cable will require a 25-pin DB-25 connector at each end. The modem requires a male DB-25 connector, i.e., with exposed pins. Computers and terminals vary, however. Check the receptacle for the communications (serial) port on the rear panel of your machine. It will be marked MODEM, COMMUNICATIONS, or EIA, for the Electronic Industries Association. (Don't use the port marked PRINTER or AUX.) If your communications port's receptacle does not have exposed pins, it requires a male connector also. If it has exposed pins, it requires a female connector.

FOR NEW USERS

If you're a new modem user, you should know some basic concepts about computer/modem operations. ➤ We suggest you read Appendix A, "Modems: Concepts and Characteristics." Then proceed to Chapter 2, "Set-Up and Testing."

FOR OLD HANDS

If you're already familiar with modems and their use, you'll want to go directly to Chapter 2, "Set-Up and Testing."

CHAPTER 2
SET-UP AND TESTING

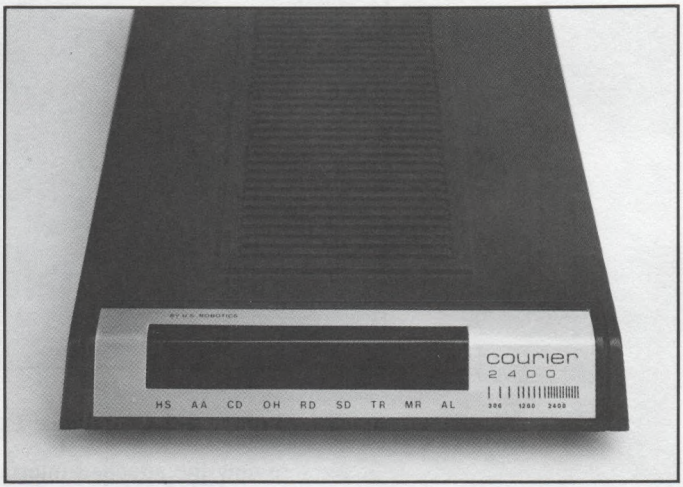

Figure 2.1—Courier 2400

PACKAGE COMPONENTS

The box containing your Courier 2400 contains the following items in addition to this manual:

- The Courier 2400 modem
- An RJ11C phone cord
- A power adapter
- A Courier Quick-Reference card, in the manual
- Your warranty card, to be filled out and returned to USRobotics, Inc.

ASSEMBLING THE COURIER

Follow these simple steps to connect the modem to your computer or terminal:

1. Turn off the computer or terminal and its peripheral devices.
2. Examine the label on the bottom of the modem. In addition to the summary tables, the label contains your serial number and icons to guide you in assembling the modem. Then check the following photograph of the back of the modem.

Figure 2.2—Interface End, Courier 2400

3. Now review the attached interfaces in Figure 2.3.

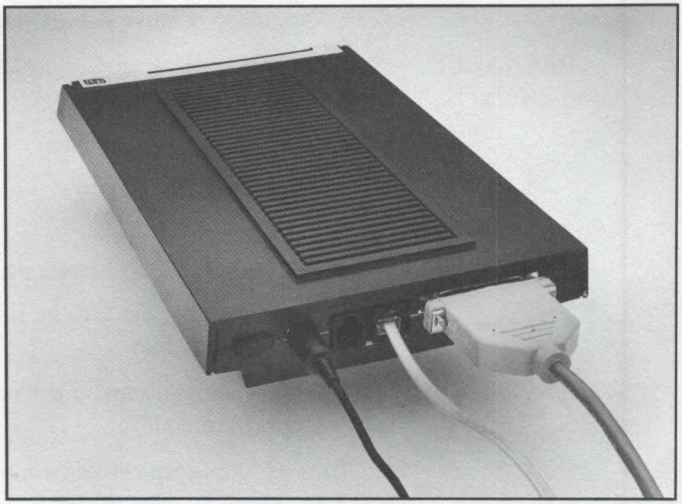

Figure 2.3—Connected Courier 2400

4. Check to make sure that the power switch is OFF; press it towards the zero in the 0/1 icon on the bottom label. Then plug the small end of the power supply cord into the power jack at the back of the modem, and plug the power adapter into a standard 115-volts AC wall socket.

Disconnect your present phone cable from the wall jack. Plug one end of the phone cord that came with the modem into the wall jack, and the other end into one of the phone jacks at the rear of the modem.

NOTE: Older telephone installations may not have the appropriate modular wall jack and plug. Adapters and RJ11C connectors are available from your telephone company or computer dealer.

If you want to keep your telephone connected, plug its cord into the other jack at the rear of the modem. You can then use both your telephone and modem for phone calls, but not at the same time. ➤ If you wish to talk to someone at another site before transferring data, see Appendix E-1, "Using Both Voice and Data Communications." The appendix explains how you can first talk and then switch control to the modem without making separate calls.

5. Next, check the positions of the DIP Switches located in the well on the bottom of the modem. These switches are set at the factory to the positions desired by most users, as shown in Figure 2.4.

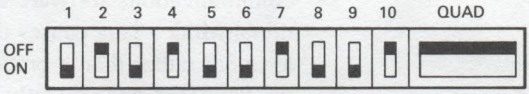

Figure 2.4—DIP Switch Factory Settings

➤ Refer to the DIP Switch Summary in Appendix B-3 to compare the factory settings with your requirements, and make any necessary changes. If you're using a computer, you may also wish to check Appendix B-4, which contains DIP switch settings required by a number of telecommunications software packages. If you're connecting the Courier to a dedicated line or to a small interoffice or PBX system, refer to Appendix E-4 for special installation and operating instructions.

6. The final step is to connect the modem to the computer or terminal. If you followed the instructions under "Operational Requirements" in Chapter 1, you should have the correct RS-232C cable connectors for your equipment. Attach the appropriate plugs to the modem and to the serial port of the computer or terminal, labeled "Modem," "Communications," or "EIA."

NOTE: When you are using the modem, be sure not to cover the vents on the top of the case.

The modem is now ready to be tested and operated.

TESTING THE COURIER 2400

To verify that your modem is working properly, follow these steps:

1. Turn on your computer or terminal and clear the screen. Then turn the Courier's power switch ON. These front indicator LEDs will light up:

HS	High speed: 2400 bits per second
MR	Modem Ready/Power
TR	Data Terminal Ready (if you haven't changed the factory setting of DIP switch 1)

2. If you're using a personal computer, load your telecommunications software and put your computer in Terminal Mode. This causes the computer to function as a terminal rather than a processor: everything you type at the keyboard goes directly to the modem.

   ➤ Appendix A includes information on Terminal Mode. If necessary, refer to your telecommunications software documentation for instructions on entering Terminal Mode.

3. Next, check to see if your machine and modem are communicating with each other by entering the command for getting the modem's "attention." (Type either upper or lower case letters. In this manual, the Carriage Return or Enter key required to issue commands is represented by the characters <cr>. Don't type the angle brackets; they are part of the conventional expression for the Carriage Return key.)

   Type the following:

   AT <cr>

If everything is correct, the modem will respond as follows:

OK

NOTE: The modem is shipped with DIP switch 4 UP, causing the modem to display (echo) your keyboard commands. If your typed command is not displayed, your local echo is OFF. To turn the local echo ON, send the modem the following command. The AT prefix alerts the modem to receive a command; E1 turns the local echo ON.

ATE1 <cr>

If double characters appear on the screen, both your modem and software are set to local echo ON. Either set your software to local echo OFF, or turn the modem's echo OFF with this command:

ATE0 <cr>

4. If no OK appears on your screen, check out the connections at the interface end of the modem. Then carefully review the previous instructions to see if you've missed something.

5. Another way to verify that the modem is working properly is to have the modem perform an *Analog Loopback Self-Test*. During this test, the modem modulates and demodulates data sent to it, and sends the data back to your computer or terminal for display on the screen. There are three simple steps.

   a. The test option used here causes the Courier to modulate and demodulate its internal test pattern and return that pattern to your screen. Enter the following command. Don't forget the Carriage Return.

   ATS16=5D <cr>

   When the modem enters Analog Loopback Mode, the AL indicator at the front of the modem lights up. The modem goes "off hook" (the equivalent of picking up a phone receiver), sends the message CONNECT 2400 to the screen, and then sends the test pattern.

   Be sure the modem isn't set to X2, X4, or X6 or it will return the NO DIAL TONE result code and hang up.

b. When you're satisfied with the test, terminate the operation by pressing any character key on the keyboard. The modem goes back "on hook" (the equivalent of hanging up the phone), and responds with the message NO CARRIER.

c. Reset S-Register 16 for normal Data Mode operations by entering this command:

ATS16=0 <cr>

You can now be assured that your modem is installed and working properly. You may want to take the time at this point to read the following information on other tests, or skip to Chapter 3 for information on calling, answering, and control operations.

Additional Test Procedures

In normal operations, modems communicate via two frequencies within the communications channel, one low and the other high. When sent a Dial command, the Courier enters what is called Originate Mode, dials and, when the remote modem answers, transmits at the low (Originate) frequency. The remote modem, on answering the call, enters Answer Mode and sends its signals at the high frequency. The frequency each modem uses to transmit or receive depends on whether it is originating or answering a call.

When in Analog Loopback Mode, the modem changes its operations. During testing, the modem transmits and receives on the same frequency, either Originate (low) or Answer (high). In Step 5 earlier, the D (for Dial) in the command forces the modem to test the Originate frequency. To test the Answer frequency, substitute the Answer command, A, as follows:

ATS16=5A <cr>

S-register 16 has five settings, explained in what follows.

0	Data Mode (no testing)
1	Analog Loopback
2	Dial Test
4	Test Pattern
5	Analog Loopback with Test Pattern

1. To perform analog loopback testing by sending your own data and verifying it at the screen, i.e., without the test pattern, use either of these commands:

   ATS16=1D <cr>
   ATS16=1A <cr>

   The modem enters Analog Loopback Mode, goes "off hook" and displays the message CONNECT 2400.

   Type any message you wish at the keyboard. It is looped through the modem and returned to the screen.

   End the test by not typing anything for at least one second and then typing the following characters. (Do not type the AT prefix or enter a Carriage Return.)

   +++

   The three pluses, preceded and followed by one-second pauses of no data, are an escape code that forces the modem back to Command Mode. The modem returns the OK message.

   To have the modem exit Analog Loopback Mode and hang up the phone, reset register 16 for normal data operations, as follows:

   ATS16=0 <cr>

2. The Dial Test is used to test the frequencies of Touch-Tone values. When register 16 is set to 2 and a single Touch-Tone value is dialed (e.g., ATD7 <cr>), the modem continues to transmit that tone until another Carriage Return is entered. This test is rarely if ever needed by users.

3. The Test Pattern alone (ATS16=4 <cr>) is used for testing equipment and the phone line. If S16 is set to 4 and a Dial command issued, the Courier transmits the test pattern upon connection to the remote system. If set for Auto Answer (DIP switch 5 UP), the Courier transmits the test pattern when it answers a call.

4. The preceding instructions test the modem at 2400 bps. To test the modem at 1200 or 300 bps, follow the same procedures, but first set your terminal or software to the

desired rate. The Test Pattern, however (options 4 and 5), is not available at 300 bps. To test the modem at 300 bps, set your terminal or software to 300 bps and follow the instructions in Number 1, above.

5. It might happen that you have issued either S16 = 1 or 5 and the AL front indicator light is on, indicating Analog Loopback Mode, but you haven't yet sent a Dial or Answer command to initiate testing. If the modem is also set for Auto Answer and a call comes in, the Courier resets S16 to zero and answers the call.

NOTE: After any testing, be sure to reset S-register 16 for normal Data Mode operations:

ATS16 = 0 <cr>

CHAPTER 3
OPERATING THE COURIER 2400

The modem operations covered in this chapter include the following:

- Calling another computer or terminal
- Controlling the modem's operations
- Using the Auto Answer feature
- Using the Help screens, information requests, and Morse code.

Remember that if you're using a computer, it must be in Terminal Mode for the modem to execute your commands.

AUTOMATIC DIALING

To place a call to another modem, you can always dial manually, and then turn control over to the modem. But the Auto Dial feature lets you tell the modem via the keyboard to dial any phone hooked into the Bell or Bell-compatible system anywhere in the world.

Preparation

Before calling another modem, you need to know the transmission rate, word length (7- or 8-bit characters), type of parity (none, odd, even, mark, space), and number of Stop bits (1 or 2) accepted by the remote modem.

In rare instances, a system may require an 11-bit data format (8-bit character, 1 parity bit, plus Start and Stop bit) rather than the more typical 10-bit format. In this case, review Appendix E-3 for instructions on changing the Courier's 10-bit default.

Automatic Data Rate Fallback

The Courier's default transmission rate is 2400 bps. However, if you call a modem that is operating at 1200 bps, the Courier automatically falls back to that rate. In all other situations, the Courier determines its transmission rate from the rate at which it receives data from the terminal or computer. Thus, if you are calling a 300-bps modem, you need to set your terminal or software to that rate.

The fallback feature doesn't operate in reverse. If you've set the terminal or software to 1200 bps, you need to reset it to 2400 bps to have the modem operate at the higher speed.

When the Courier receives an incoming call, it automatically adapts to the caller's transmission rate. The procedure is described in Appendix E-2, "High Speed/Low Speed Protocol."

Automatic Retrain

When the Courier operates at 2400 bps, the HS (high speed) LED is on. It may happen that you'll see this light go off momentarily during a call. This indicates that one of the modems has sensed that the data may be unreliable due to a problem in the phone line connection, and the modems are retraining. The modems stop the transfer of data for about a second while they resynchronize. The HS indicator light goes on again when they resume Data Mode operation.

Retraining only occurs during 2400-bps communications.
➤ For a description of the signaling sequence, see Appendix F.

Command Format

The command set is simple and easy to use. Use either upper or lower case letters. If a command is mistyped or otherwise invalid, the modem returns the message ERROR.

Use the Back Space key to correct any typing errors that occur after the AT prefix, before you enter the Carriage Return. If you've mistyped the AT prefix (for example, you've typed AY), the modem won't erase it and won't carry out any commands that follow in the command line. In this case, just enter a Carriage Return and try again.

The following sample Dial string consists of four essential elements:

ATD1234567 <cr>

- The AT (attention) command
- The D (dial) command
- The phone number of the call's destination
- A Carriage Return (<cr>)

Attention (AT)

The AT command notifies the modem that you are addressing it with an instruction. You can issue this command alone (with a Carriage Return) any time you want to check that the modem and terminal/computer are communicating. If all is well, the modem responds OK.

The characters AT also must prefix every command except the reexecute command (A/) and the escape code (+ + +), discussed later in this chapter.

Dial (D)

The modem goes "off hook"—the equivalent of your picking up the phone—then enters Originate Mode and dials the number sequence that follows. It also executes any other commands or options included in the command line.

For example, the following command tells the modem to stop the display of commands (E0, turn off the local echo), to dial (D) using Touch-Tone dialing (T), and to turn off the speaker (M0). The spaces shown are ignored by the modem and are only included here for readability.

AT E0 DT 1234567 M0 <cr>

Result Codes and Dialing

If the modem is set to its defaults and it makes a connection within 30 seconds, it returns one of the following messages, indicating the bit rate of the call:

CONNECT	(300 bps)
CONNECT 1200	(1200 bps)
CONNECT 2400	(2400 bps)

The ATX*n* command (*n* = 0–6) is used to select the result code set. The default setting, X1, selects the Extended set that includes the rate-specific messages just mentioned. X0 selects the Basic set, which sends only the CONNECT message, regardless of the bit rate.

If set to X0 or X1 and the modem fails to make a connection within 30 seconds, it hangs up and returns the message NO CARRIER.

When set to X2 or higher, the modem displays an Advanced set of call-progress codes such as BUSY, NO ANSWER, a VOICE rather than modem answer, and RINGING. Settings of X2 and above also control other aspects of autodialing, and are fully described later under "The Result Codes." They are mentioned here because they affect some of the dialing options explained in the following paragraphs.

Adaptive Dialing (X2–X6)

When any of the X2 through X6 options is in effect and you don't issue a dialing type, the Courier uses Touch-Tone dialing, which is faster than its default type, pulse (rotary) dialing. However, if the phone company central office doesn't have Touch-Tone detection equipment, the modem can not "break dial" and continues to detect the dial tone. If this occurs, the modem automatically reverts to pulse dialing.

User-Selected Dialing Type (P, T)

If set to X0 or X1, the modem uses pulse dialing unless instructed otherwise. This command sets the modem for Touch-Tone dialing:

ATT <cr>

The following command resets the modem to pulse dialing:

ATP <cr>

You can switch from one dial type to another within a dialing sequence. For example, you might have a phone line that only accepts pulse dialing (slower than Touch-Tone dialing) but subscribe to a long-distance service that accepts tone dialing, such as MCI. You can switch to tone dialing once you've hooked into the long-distance service. In the following example, a switch is made to tone dialing before entering a service account number and the long-distance destination. (The commas are discussed shortly.)

ATDP 9,,7654321,,T 55555,,1 312 1234567 <cr>

NOTE: The modem remains set for Touch-Tone dialing until it is reset or the ATP (pulse) command is reissued.

Punctuation

The modem ignores most punctuation but acts on the comma, semicolon, quotation marks, and exclamation point embedded in a Dial command as follows.

Pause (,)

A comma causes a two-second delay in the dial sequence. The following example contains four-second delays at several points:

ATDP 9,,7654321,,T 55555,,1 312 1234567 <cr>

The first four-second pause is to access an outside line after dialing 9, the second to make sure the remote computer is ready for the user's account number, and the third, to delay before dialing the long-distance number.

Such delays, however, may not be necessary. Experiment to be sure that pauses are required for a successful connection.

Dial and Return to Command Mode (;)

Ordinarily, a Dial command causes the modem to dial and establish a connection (go online) with another modem. No longer in Command Mode, the only command the modem recognizes is an escape code, discussed shortly. You can, however, have the modem dial and return to Command Mode without establishing a connection with another modem. This is done by appending a semicolon (;) to the end of the Dial command, forcing the modem to return to Command Mode after dialing, but to maintain the off-hook condition. The modem returns the OK message, indicating it is ready to accept commands.

For example, you may want the modem to phone a recorded service for weather or sports information but return to Command Mode to do something else while you're listening. Just append a semicolon to the Dial command, as in this example:

```
ATDT1234567; <cr>
OK
```

When you've finished listening, issue the command to hang up. (The command is ATH, explained later in this chapter.)

A second example is an information or other service that requires a Touch-Tone entry of an ID as part of the log-on procedures. The following sequence is an example.

ATDT1234567; <cr>	(dial the service's telephone number and return to Command Mode)
OK	
ATDT65432; <cr>	(dial ID and return to Command Mode)
OK	
.	
.	
.	
ATH <cr>	(session is finished; hang up)
OK	(modem is now on hook, in Command Mode)

Dialing Letters (")

Quotation marks are used to have the modem dial abbreviations and acronyms used as phone "numbers," such as DIAL USR (the USRobotics Sales Department's 800 number). The option is called Quote Mode. Quotation marks are inserted at the beginning of the alphabetic string:

```
ATDT"BBS-NEWS <cr>
```

Use closing quotation marks after the letter string if another command is following it.

Flash Switch-Hook (!)

This command is used to transfer a call. The modem goes on hook for 0.5 seconds, then off hook 0.5 seconds, that is, flashes the switch-hook, and then continues with the dial string.

The following example tells the modem to go on/off hook before dialing the specified extension. The modem returns to Command Mode (;) and then hangs up (H).

ATDT !1234;H <cr>

Other Punctuation

The modem doesn't act on any punctuation except the comma, semicolon, quotation marks, and exclamation points. If you insert spaces in a command, the modem doesn't even store them in its command buffer. Spaces are totally ignored. If you type hyphens or parentheses, for example, (312) 123-4567, the modem stores them in the buffer as command characters but otherwise ignores them. Generally, users prefer fewer key strokes and omit unnecessary punctuation.

NOTE: This is true for modem commands. Communications software may require different punctuation conventions. Also, don't type in an asterisk (*) or pound sign (#) unless you want the modem to dial either of those Touch-Tone values.

Wait for a Second Dial Tone (W)

This command is useful in situations where you must wait for a second dial tone before entering a password, for example, when using MCI, Sprint, or other long-distance service. The following example tells the modem to dial the service number, wait for the second dial tone, dial the ID, pause two seconds, then place the long-distance call.

ATDP 555-1234 W 12345, 312-123-4567<cr>

NOTE: This command executes only if result code option X3 or greater has been issued. If the modem is set to X2 or lower, the modem interprets the W as a comma (two-second pause). ➤ See "The Result Codes" later in this section.

Wait for an Answer (@)

Some online services answer the phone and return a tape-recorded request for information before processing transactions. In such instances, the @ command can be used in the Dial string to tell the modem to detect at least one ring, wait for five seconds of silence at the other end of the call, and then continue to execute the Dial string.

To use the @ command, set the modem to X3 or X4. If the modem is set to X2 or lower, it returns an ERROR message when encountering the @ character in a command string. If the modem is set to X5 or X6, it hangs up when it detects a

voice answer and sends the message VOICE. ➤ See "The Result Codes" later in this section.

In the next example, the modem is set to the X4 result code option, and dials a banking service. Each occurrence of @ in the example indicates a five-second wait for silence after taped requests from the bank for the labeled items. The transaction code might be used, for example, to request an account balance.

Password

ATX4 DT1234567 @ 12345 @ 6789 @ 2;

Account # Transaction Code

If the necessary conditions don't occur—no rings, or no following five seconds of silence—the modem times out as it normally would (after 30 seconds). It then sends the message NO ANSWER to the screen and aborts the command.

Reversing Originate/Answer Frequencies (R)

This command allows calls to an originate-only modem. It reverses the modem's originate/answer frequencies, forcing the Courier to dial out at the answer frequency. The command follows the Dial command, before or after the phone number:

AT D1234567R <cr>
AT DR1234567 <cr>

The Required Carriage Return (<cr>)

The modem only executes a command line when it is entered with a Carriage Return (<cr>).

Command Length

Command lines may be as long as 40 characters before a Carriage Return is entered. The modem does not count the mandatory AT or Carriage Return characters, nor does it count spaces.

Redialing (A/, >)

If the modem dials but the call doesn't get through, perhaps due to a busy signal or some other problem, the modem responds NO CARRIER. The Dial string, however, remains in the Courier's command buffer. You can have the modem automatically redial with this command:

A/

Important points to remember about the A/ command:

1. A/ doesn't require the prefix AT or a Carriage Return, and doesn't clear the command buffer. You can issue it repeatedly to have the modem redial.
2. A/ causes the modem to reexecute any command in the buffer. If you issue an additional command, the buffer clears to accept the new command. If you want the modem to try the call again but have already sent a new command, you'll need to retype the Dial string.

A second way to have the modem redial is to include the Repeat command (>, or greater-than character) in the Dial string. This is especially useful if the line is often busy at the destination number. The command can be inserted before or after the Dial string:

```
AT > DT 1234567 <cr>
AT DT 1234567 > <cr>
```

The modem enters Repeat Mode, dials the number, waits the default 30 seconds for a carrier, and hangs up. Then, after a two-second pause, it redials up to a maximum of ten tries. The automated redial limit of ten is mandated by the Canadian Department of Communications (DOC) to prevent tying up local telephone company exchanges with unconnected calls.

The cycle continues until a connection is made or the modem exits Repeat Mode after ten attempts. If you want to abort the cycle, just press any character key when the modem pauses before dialing again.

With all other commands, the Repeat command causes continuous reexecution (Repeat Mode) until you terminate it by pressing any character key.

The two-second pause between reexecutions is the same as that for the comma pause. You can redefine the duration by changing the setting of S-register 8, described later in this chapter.

Canceling Dialing

To cancel dial-command execution, press any character key. If you inadvertantly hit a key on the keyboard while the modem is dialing, the call is canceled. If this occurs, just type A/ and the Courier will redial.

Auto Dialing Summary

Here's a brief review of what's been covered so far:

- Commands may be typed in upper or lower case.
- All commands to the modem must begin with the characters AT and be entered with a Carriage Return (<cr>), except for the reexecute command (A/) and the escape code (+ + +).
- The Dial command (D) can be used with the following options:

P	Pulse dialing (Default)
T	Touch-Tone
,	Two-second pause
;	Dial and return to Command Mode
"	Dial the following alphabetic characters
!	Transfer the call (flash switch-hook)
W	Wait for a second dial tone
@	Wait for an answer
R	Reverse frequency; modem enters Answer Mode and dials

- You can switch from pulse to tone dialing within a dialing sequence to speed up dialing. The modem retains the last-issued dial-type setting.
- The modem counts but ignores conventional punctuation except for the comma, a semicolon at the end of a Dial command, quotation marks, and the exclamation point. For economy, skip all punctuation except those optional characters.
- The maximum command length accepted by the modem is 40 characters. The modem does not count spaces or the AT and Carriage Return characters.
- Cancel dialing by pressing any character key on the keyboard.
- The A/ command causes the modem to reexecute the last-issued command stored in the command buffer, and can be used to have the modem redial.
- The Repeat command (>) forces the modem into Repeat Mode, which is exited when you press any character key. Inserted before or after a Dial string, > causes the modem to redial automatically until a connection is successfully established, or up to a maximum of ten tries.

CONTROLLING MODEM OPERATIONS

This section explains the following operations:

- Command Mode/Online toggling
- Hanging up
- Using the Audio Monitor
- Adjusting the following modem settings

  Transmitter enabled/disabled
  Command Mode/Online local echo
  Result code modes and sets
  Resetting to default settings
  S-registers

- Making inquiries

Command Mode/ Online Toggle

Once the modem is online, it doesn't recognize keyboard commands except for the following escape code sequence:

—Wait one second after entering the last item of data
—Type: + + +
—Wait one second before typing any data

The sequence causes the modem to return to Command Mode and await commands. Do not type the AT prefix or a Carriage Return. The guard time of one second before and after the code prevents the modem from misinterpreting the occurrence of + + + in the transmitted data stream.

If necessary, the character used in the escape code can be changed by resetting S-register 2. ➤ See "The S-Registers," later in this chapter, and Appendix B-5.

You can use the escape code in either of two ways. You can have the modem maintain the connection and return to Command Mode, or have the modem hang up (go on hook) before returning to Command Mode. Operation is controlled by the setting of DIP switch 9, as follows:

If DIP switch 9 is DOWN, the modem maintains the connection, returns to Command Mode, and displays the OK message. This is the Courier's factory setting.

If DIP switch 9 is UP, the modem hangs up, returns to Command Mode, and sends the message NO CARRIER. One advantage of this automatic disconnect is that you're not likely to inadvertantly run up an all-night phone bill.

WARNING: **For unattended modem operations**—In rare instances, the + + + escape code sequence may fail to terminate a call. If you are running the modem under software control for unattended operations, we suggest you use the surefire method of *dropping the RS-232C DTR signal for at least 50 milliseconds,* to ensure against costly phone charges. Methods of turning the DTR signal off, e.g., closing the communications port, differ from one computer to another.

Online Toggle (O)

If DIP switch 9 is DOWN (the modem responds to the escape code by maintaining the connection when it returns to Command Mode), you can issue commands and then toggle the modem back online with the O command:

ATO <cr>

Hanging Up (H*n*, + + +)

When DIP switch 9 is DOWN and you send the escape code, the modem retains the phone connection when it returns to Command Mode. If you want the Courier to disconnect, issue the command to hang up when you see the OK message, as follows:

ATH <cr>

If DIP switch 9 is UP, you don't need to issue the H command, as the modem automatically disconnects.

NOTE: DIP switch 9 settings also have "Dumb Mode" functions if DIP switch 8 is set UP to disable command set recognition. ➤ See Appendix B-3.

Using the Audio Monitor

There are several ways you can save time by using the modem's speaker as an audio monitor. After the Courier 2400 dials a number, it waits 30 seconds for a high-pitched answer tone from the other modem, immediately followed by data signals, called a *carrier*. These signals must occur before a data link is established.

If someone answers the phone, or if the line is busy, the modem sends the message NO CARRIER to your screen after 30 seconds. If you listen to the speaker, you can respond immediately instead of waiting for the modem to display its result code.

For example, if you hear someone answering the call, you might pick up the phone and talk to the person or cancel the call by pressing any key on the keyboard. In the same way, you can cancel a call when you hear a busy signal.

You can also hear if dialing is proceeding too fast for the system. Terminate the call (press any key) and reenter the Dial command with a comma or two to ensure enough time for the modem to do its job. This applies to accessing an outside line (dialing 9, for example) as well as to checking out whether a public service has enough time to respond to your account number and the like.

Remember, though, that in data communications, everyone is interested in speed as well as accuracy. You're best off building in as few delays as possible. Use the speaker to help you.

Monitor (Speaker) Control (M*n*)

There are four optional settings for the modem's speaker, M0-M3, as follows:

M0

The command ATM0 turns the speaker OFF entirely so that you don't hear the modem go off hook, dial, etc.

M1

The speaker is ON until CONNECT. This is the default setting and lets you monitor call progress until a link is established or until the 30-second timeout and the NO CARRIER message.

When the modem dials and the other modem goes off hook, you can hear the high-pitched answer tone, meaning that the remote modem is ready to communicate with yours. After this, you can hear a second noise as the modems "shake hands" electronically and establish a data-transfer connection. Your modem then displays a CONNECT message, indicating that you can begin transmitting to the other computer. At this point, the modem disconnects the speaker and data transmission sounds are suppressed.

M2

The speaker is ON continuously, including during data transmission.

M3

The speaker doesn't go ON until after the last digit is dialed, then goes OFF at CONNECT.

Additional Modem Settings

Commands to adjust modem settings can be issued separately, as in this command to set local echo ON:

```
ATE1 <cr>
```

Commands can also be issued in a string, as in the next example. The command instructs the modem to activate the local echo (E1), return the Advanced set of call-progress result codes (X2), and dial a number using Touch-Tone dialing. (Spaces are for print readability only.)

AT E1 X2 D T 1 800 1234567 <cr>

Each time you issue a command for a new setting, the modem continues to operate at that setting until you do one of the following.

- Enter a command for a new setting.
- Use the command to reset all of the default settings. (➤ See "Reset," in the listing that follows.)
- Turn off the modem at the end of a work session. When the Courier is powered on again, all default settings are reinstated.

Numeric Parameters

The modem interprets a missing numeric parameter as zero: ATH (hang up) is the equivalent of ATH0. The following list defines the commands, options, and defaults.

Receive Only (Cn)

If an additional terminal and modem share the phone line for monitoring purposes, the second modem is placed in Receive Only state by disabling its transmitter.

C0 Transmitter disabled; additional device set to Receive Only.

C1 Transmitter enabled. Default. Normal operation of one-modem-only connection to phone line.

Command Mode Local Echo (En)

Local echo ON/OFF when the modem is in Command Mode, i.e., not online to another system. The Courier is shipped with DIP switch 4 set UP and defaults to local echo ON when the modem is powered on or reset. These commands control the echo independently of the power-on/reset default.

E0 Command Mode echo OFF. The modem does not display keyboard commands.

E1 Command Mode echo ON. The modem displays keyboard commands.

Online Local Echo (Fn)

Local echo ON/OFF when the modem is transmitting data to another system. In microcomputer communications this is sometimes called the ''Duplex'' setting, although duplex operations are distinct from local echoing. ➤ For more information see ''Half/Full Duplex'' in Appendix A.

F0 — Online echo ON (Half Duplex). As the modem transmits data to a remote system, it also sends a copy of the data to the screen.

F1 — Online echo OFF (Full Duplex). Default. The modem does not display a copy of the data it is transmitting. The remote system may send a copy of the data it has received (called remote echo), which the Courier then sends to your local screen.

Quiet Mode (Qn)

Display of modem result codes (messages) ON/OFF. The Courier is shipped with DIP switch 3 DOWN and defaults to display ON when the modem is powered on or reset. The commands control the display independently of the power-on/reset default.

Q0 — Result codes are displayed.

Q1 — Result codes are suppressed (made ''quiet''). This is useful when the messages might interfere with the data stream.

Response Modes (Vn)

Result codes are sent to the screen in either words (Verbal Mode) or numbers (Numeric Mode). For example, the numeric equivalent of OK is zero (Ø). The Courier is factory-set to default to verbal messages when it is powered on or reset (DIP switch 2 is UP). Use the V command to select verbal/numeric result codes independently of the power-on/reset default. (A code table is in the next section, ''The Result Codes.'')

V0

Numeric Mode. Numeric result codes are followed by a Carriage Return but no Line Feed, as in the following example, where a 3 is returned (for NO CARRIER).

ATD1234567 <cr>

becomes

3TD1234567 <cr>

V1

Verbal Mode. Verbal responses are preceded and followed by a Carriage Return and a Line Feed, as in the following example:

ATD1234567 <cr>
NO CARRIER

Reset (Z)

The following command resets the modem to all of its default settings; it has the same effect as powering on the modem.

ATZ <cr>

Use this command also to initiate a new setting for DIP switches 2–5 or 9.

The Result Codes (X*n*)

Result codes can be returned in Verbal or Numeric Mode, as described earlier under "Response Mode." The following table, listing both forms of the messages and the available options, should make it easy for you to select the result codes you want. The table includes optional functions that are dependent on the result codes in effect.

The format of the command to select a result code set is ATX*n*, where *n* is a value from 0 through 6.

RESULT CODES OPTIONS TABLE

	Commands						
	X0	X1	X2	X3	X4	X5	X6
RESULT CODES							
0/OK	X	X	X	X	X	X	X
1/CONNECT	X	X	X	X	X	X	X
2/RING	X	X	X	X	X	X	X
3/NO CARRIER	X	X	X	X	X	X	X
4/ERROR	X	X	X	X	X	X	X
5/CONNECT 1200		X	X	X	X	X	X
6/NO DIAL TONE			X		X		X
7/BUSY				X	X	X	X
8/NO ANSWER (Requires @; replaces NO CARRIER)				X	X	X	X
9/Reserved for future use							
10/CONNECT 2400		X	X	X	X	X	X
11/RINGING						X	X
12/VOICE						X	X
FUNCTIONS							
Adaptive Dialing			X	X	X	X	X
Wait for 2nd Dial Tone (W)				X	X	X	X
Wait for Answer (@)				X	X	X	X
Fast Dial			X		X		X

Before using the table, review this summary of the options:

- The Extended set is the default, codes 0–5 and 10. This set includes the CONNECT 1200 and CONNECT 2400 messages. ATX1 resets the modem to this default set.

The Courier 2400 sends these messages when it makes a successful connection after dialing, or after answering a call. For information on how the modem handles the varying bit rates of incoming calls, see Appendix E-2. Also, if your computer doesn't automatically adjust to the bit rate of an incoming call, Appendix E-2 includes suggestions on programming your computer to respond to the modem's Extended code set.

- The Basic set, codes 0–4, does not include rate-specific CONNECT messages. Use ATX0 to select the Basic set.
- X2 or higher is required for adaptive dialing, in which the modem automatically uses Touch-Tone dialing and, if that doesn't work on the line, reverts to pulse dialing.
- W and @ are only available with X3 or higher.
- Fast dial causes the modem to dial as soon as a dial tone is detected, rather than wait the normal two seconds. If there is no dial tone, the modem times out after 5 seconds and sends the NO DIAL TONE (6) result. This feature is available with X2, X4, and X6.
- If set to X3–X6, the modem hangs up when it detects a busy signal and sends the BUSY (7) result code.
- When X3–X6 are used with the @ command (wait for an answer) and there is no answer at the remote end, the modem sends the message NO ANSWER rather than the standard NO CARRIER.
- If set to X5 or X6, the modem hangs up on detection of a voice answer and sends the VOICE (12) result code.

The S-Registers (S*r*=*n*)

The S-register functions and commands give you greater flexibility in tailoring modem operations. While many users seldom need to adjust the register settings, the information below will enable you to change them if the need arises.

Use the following command format, where *r* identifies the register and *n* is a decimal value of 0 through 255.

ATS*r*=*n*

For example, you used the S16 function to perform the analog loopback/test pattern self-test in Chapter 2 by issuing this command, which included the Dial command:

ATS16=5D

You can display a Help screen of the S-register functions by issuing this command:

ATS$ <cr>

To query the setting of a particular register, use ATS*r*? as in this example:

ATS8? <cr>

➤ In addition to the above online help, you'll find a summary of S-register settings, functions, and defaults in Appendix B-5, in the Quick-Reference card, and on the bottom label of the Courier. Appendix B and the Quick-Reference card also include an ASCII chart.

Default settings are reinstated each time the modem is reset with the ATZ command or powered on.

S0 Sets the number of rings on which to answer when in Auto Answer Mode. Defaults to 1 when DIP switch 5 is UP. S0=0 (no rings) suppresses Auto Answer, equivalent to setting DIP switch 5 DOWN.

➤ See "Automatic Answering" later in this chapter.

S1 Counts and stores the number of rings from an incoming call.

S2 Sets the ASCII decimal code for the escape code character. Default = 43 (+). A value of 128–255 disables the escape code.

S3 Sets the ASCII decimal code for the character recognized as Carriage Return. Default = 13.

S4 Sets the ASCII decimal code for the character recognized as Line Feed. Default = 10.

S5 Sets the ASCII decimal code for the character recognized as Backspace. Default = 8.

S6 Sets the number of seconds the modem waits before dialing. Default = 2. If the modem is set to X2, X4, or X6 it

ignores this register and dials as soon as it detects a dial tone (fast dials).

S7 Sets the number of seconds the modem waits for a carrier before sending the NO CARRIER message. Default = 30. This option is especially useful for international calls, when it may take more than 60 seconds to make a connection.

S8 Sets the duration, in seconds, for the pause option (,) in the Dial command and the pause between Repeat command (>) reexecutions. Default = 2.

S9 Sets the required duration, in tenths of a second, of the remote modem's carrier signal before recognition by the local modem (Carrier Detect Time). Default = 6.

S10 Sets the duration, in tenths of a second, the modem waits after loss of carrier before hanging up. Default = 7.

This setting provides a guard time so that the modem can distinguish between a true disconnect (hanging up) by the remote modem and a line hit or other disturbance that momentarily breaks the connection. Users with call waiting may wish to adjust this setting upward to prevent the modem from mistaking the signal for a second call as a disconnect by the remote modem.

S11 Sets the duration and spacing, in milliseconds, of dialed Touch-Tones. Default = 70.

S12 Defines the escape code sequence guard time, in 50ths of a second. Default = 50 (one second).

S14 Sets the product code (24*n*) returned when ATI0 is issued. ➤ See "User Inquiries," following this section. If you use Smartcom 2.0 software, follow the instructions in Appendix B-4.

S16 Modem self-testing, as follows:

S16 = 0 Data Mode (no testing)
= 1 Analog Loopback
= 2 Dial Test
= 4 Test Pattern
= 5 Analog Loopback with Test Pattern

➤ The last section of Chapter 2 explains test procedures.

User Inquiries (I*n*, K*n*)

The command ATI*n* is used to query the modem for the following information.

I0 The modem returns a 3-digit product code. If you call USRobotics' Technical Support Department, you may be asked for this product code. If you use Smartcom 2.0, follow the instructions in Appendix B-4.

I1 The modem performs a checksum of its read-only memory (ROM) and returns the result to the screen. This function is used only in factory testing. The modem should always read the same number.

I2 The modem performs a test of its random-access memory (RAM) and returns either the OK (1) or ERROR (4) result code, followed by OK when the test is completed. You may want to use this command as a checkpoint if the modem appears to be malfunctioning.

I3 The modem returns the duration of the last call in hours, minutes, and seconds or, optionally, the actual time, depending on use of the K*n* command, as follows:

K0 Default. The modem clock is used as a call-duration timer and stores the information until the next connection is established or the modem is reset. At ATI3, the modem displays the call's duration from CONNECT to NO CARRIER. If you wish, you can maintain a call log by printing this information after each call.

K1 The modem clock is used as a real-time clock operating regardless of the presence of a carrier. Set the clock by specifying the hour, minutes, and seconds as in the following example, which sets the clock at the real time of 1:30 p.m.

```
ATI3=13:30:00 K1 <cr>
```

At ATI3, the modem displays the real time. You'll need to set the clock when you power on the modem, but the clock will not be affected by the reset command, ATZ.

I4 The modem displays its current settings. The following illustration is an example.

```
File   Telephone   Utility   Settings   Help          | C M E P S | Off Line

ati4
U.S. ROBOTICS COURIER 2400 SETTINGS...

  C=1  E=1  F=1  M=1  Q=0  V=1  X=1
  BAUD=2400  PARITY=N  WORDLEN=8
  DIAL=PULSE  ON HOOK

  S00=000  S01=000  S02=043  S03=013
  S04=010  S05=008  S06=002  S07=030
  S08=002  S09=006  S10=007  S11=070
  S12=050  S13=001  S14=000  S15=000
  S16=000

OK
```

Figure 3.1. Sample Result of ATI4 Command

NOTE: The status line at the top of the screen is a display of USRobotics' TELPAC telecommunications software for the IBM PC and PC-compatibles.

HELP Screens

The Courier 2400 provides three Help screens: for a command summary, S-register settings, and Dial command options.

Stop/Restart Display

The following command stops the display. Both keys are typed simultaneously.

<Ctrl>-S

To restart the display, use the same command or press any key.

Cancel Display

Either of the following commands cancels the display.

<Ctrl>-C
<Ctrl>-K

Command Set ($)

At AT$, the Courier displays this command set summary:

```
 File   Telephone   Utility   Settings   Help          ! C M E P S ! Off Line
at$
HELP, Command Quick Reference (CTRL-S to Stop, CTRL-C to Cancel)

A      Answer Call                      Kn     n=0  Call Duration Mode
A/     Repeat Last Command                     n=1  Real Time Clock Mode
Cn     n=0  Transmitter Off             Mn     n=0  Speaker Off
       n=1  Transmitter On                     n=1  Speaker On Until CD
Ds     Dial a Telephone Number                 n=2  Speaker Always On
       s=0..9 # * T P R , ; " W @ !            n=3  Speaker Off During Dial
D$     HELP, Dial Commands              O      Return On-Line
En     n=0  Do not Echo Chars           Qn     n=0  Result Codes Sent
       n=1  Echo Command Chars                 n=1  Quiet (No Result Codes)
Fn     n=0  Half Duplex                 Sr=n   Sets Register "r" to "n"
       n=1  Full Duplex                 Sr?    Query Register "r"
Hn     n=0  On Hook (Hang Up)           S$     HELP, S Registers
       n=1  Off Hook                    Vn     n=0  Non-Verbal Responses
In     n=0  Product Code                       n=1  Verbal Responses
       n=1  Checksum                    Xn     n=0  Basic Result Codes
       n=2  RAM Test                           n=1  Extended Result Codes
       n=3  Call Duration/Clock                n=2-6  Advanced Result Codes
       n=4  Register Settings           Z      Software Reset
I3=s   Sets the Clock                   )      Repeat Command String
       s=Hours:Mins:Secs                $      HELP, Command Summary
```

Figure 3.2. Command HELP Screen

S-Register Functions (S$)

At ATS$, the Courier displays a summary of the S-register functions:

```
 File   Telephone   Utility   Settings   Help          ! C M E P S ! Off Line


ats$
HELP, S Register Functions (CTRL-S to Stop, CTRL-C to Cancel)

S0  Ring to Answer On                S9  Carrier Detect Time (1/10sec)
S1  Counts # of Rings                S10 Carrier Loss Code (1/10sec)
S2  Escape Code Char                 S11 Touch Tone Spacing (msec)
S3  Carriage Return Char             S12 Escape Code Time (1/50sec)
S4  Line Feed Char                   S16 0=Data Mode
S5  Backspace Char                       1=Analog Loopback
S6  Wait Time/Dial Tone (sec)            2=Dial Test
S7  Wait Time/Carrier (sec)              4=Test Pattern
S8  Comma and Repeat Pause (sec)         5=Analog Loopback & Test Pattern

OK
```

Figure 3.3. S-Register HELP Screen

Dialing (D$)

At ATD$, the Courier displays this Dial command summary:

```
File   Telephone   Utility   Settings   Help          ! C M E P S ! Off Line

atd$
HELP, Dial Commands (CTRL-S to Stop, CTRL-C to Cancel)

0-9 Digits to Dial
*#  Auxiliary Digits
T   Tone Dialing
P   Pulse Dialing
R   Call an Originate Only Modem
,   Pause
;   Remain in Command Mode
"   Used to Dial Alpha Phone #'s
W   Wait for 2nd Dial Tone (X3-X6)
@   Wait for an Answer (X3-X6)
!   Flash Switch Hook

OK
```

Figure 3.4. Dial Command HELP Screen

USING MORSE CODE

The Courier 2400 is capable of transmitting Morse Code messages as well as computer data messages. Use these commands:

.	(dot)	Sends a 62-millisecond tone followed by 62 milliseconds of silence.
–	(dash)	Sends a 186-millisecond tone followed by 62 milliseconds of silence.
/	(space)	Sends 125 milliseconds of inter-character spacing.

The tone used in the dot and dash is 1270 Hz. The following sample command sets the modem's speaker on during data transmission and sends an SOS every 2 seconds:

ATM2 > . . . /– – –/ . . . <cr>

AUTOMATIC ANSWERING

The Courier 2400 is shipped with DIP switch 5 DOWN, Auto Answer suppressed. If the modem is OFF and you want it to automatically answer incoming calls, you can set DIP switch 5 UP to change the power-on default. Or you can turn the modem ON, put your computer in Terminal Mode, and do either of the following:

- Set DIP switch 5 UP and then reset the modem (issue the ATZ command) to initiate the new switch setting.
- Disregard the switch setting entirely and issue the command ATSØ=1. The modem will answer calls on the first ring.

When the modem senses a call coming in, it sends the message RING to the screen. It then sends a high-pitched answer tone down the phone line and waits for a data signal (carrier).

If there is no carrier detect within 30 seconds, the Courier goes on hook (hangs up). If the modems establish a connection, the Courier displays the message CONNECT, CONNECT 1200, or CONNECT 2400, depending on the calling modem's rate and your modem's result code (X*n*) setting. When the call is completed, the Courier hangs up and returns the message NO CARRIER.

Auto Answer: Points to Remember

The Courier's Auto Answer capability allows you to set your computer and modem to receive calls while you're gone. People can call your system and leave short messages for you on your screen. But keep the following in mind.

1. Terminal Mode causes your computer to operate just as a terminal. It cannot store incoming information, but only display it on the screen. When more than a screen full of data is received, data at the top of the screen scrolls off as new data is displayed. To save incoming data, use a software package with a save-file feature, such as USRobotics' TELPAC, or MicroStuf's CrossTalk.

2. If you are using the same phone line for conventional calls as well as computer messages, be sure to *disable the Auto Answer feature when you're not using the modem*. Otherwise, the modem may answer the phone before you do, greeting your caller with a high-pitched, irritating answer tone.

   You can disable Auto Answer in one of the ways mentioned above for activating it, by resetting DIP switch 5 (DOWN) or using a command. The command instructs the modem to wait for zero rings, as follows:

   ATS0=0 <cr>

CONCLUSION

This chapter has covered all you need to know to begin using the Courier 2400. Appendix C, the Reference Card, and the bottom label of the modem contain summaries of all of the commands described here.

If you have't done so already, be sure to review the appendixes to see what information they cover.

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APPENDIX A
MODEMS: CONCEPTS AND CHARACTERISTICS

THE MODEM'S PRIMARY FUNCTIONS

Data communications is the segment of telecommunications (long-distance communications) that involves the exchange of information between computers and/or computer terminals. It began with the expanded use of computers and the growing need to share information—among regional business offices, national banking systems, specialized university databases, and so on.

It was more efficient to use existing facilities to carry the data—telephone lines—than to build special networks. Telephone lines, however, are made to carry tones within the human voice range, while computers work with digital signals, either ON or OFF (1 or Ø, respectively). It was necessary to *MO*dulate the digital signals into a form that could be safely and clearly transmitted, before they were sent down the telephone line, and to *DEM*odulate them back to digital signals at the receiving end. Hence the name MODEM for the device that performs these functions.

Digital signals, with their respective binary digit values, are conventionally illustrated as in Figure A.1.

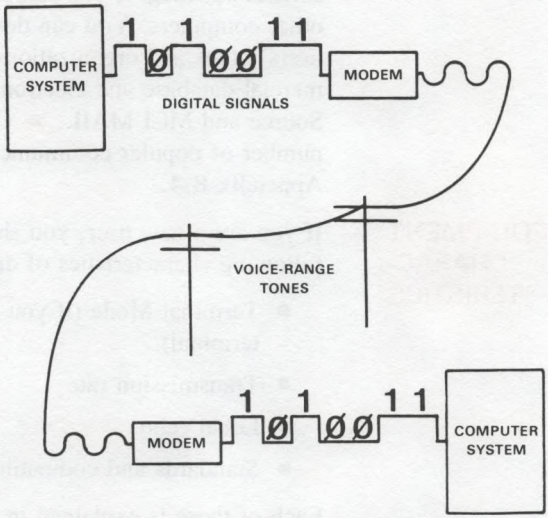


Figure A.1—Modulation/Demodulation

ADDITIONAL COURIER 2400 FUNCTIONS

Your modem is designed to do a lot more than transform signals. Thanks to advances in circuit technology, a great many time-saving functions are compactly built into the Courier. Among those functions are the following:

Auto Dialing

In response to a simple command, the Courier automatically dials phone numbers you type in at the keyboard.

Auto Answering

The Courier can be set to automatically answer the telephone and accept messages sent from other computers/terminals.

Audio Monitoring

A built-in speaker lets you hear the dialing in progress and otherwise monitor the placement of a call.

Voice/Data Communications

The Courier has two modular phone jacks. One is used to connect the modem to the wall jack. The other is available for your phone, if you want to use it for voice phone calls.

If a system you are calling includes a USR-compatible modem, you can also call and talk to the user at the other end of the communications link and then have the modems transfer data. ➤ Instructions for voice/data sessions are in Appendix E-1.

File Transfers

If you use TELPAC, CrossTalk, or similar communications software packages, you can store information received from other computers. You can download programs from various users' clubs and organizations, and store data from commercial database and electronic mail services such as The Source and MCI MAIL. ➤ Courier switch settings for a number of popular communications programs are given in Appendix B-4.

EQUIPMENT CHARACTERISTICS

If you are a new user, you should become familiar with the following characteristics of data communications equipment:

- Terminal Mode (if you use a computer rather than a terminal)
- Transmission rate
- Local echo
- Standards and compatibility

Each of these is explained in what follows.

Terminal Mode

When computers (rather than terminals) are used, they must operate in Terminal Mode for their corresponding modems to communicate. Terminal Mode causes the computer to

simulate a type of device called a *dumb terminal,* so named because it has no internal computing capabilities. When in Terminal Mode, a computer is limited to two basic functions:

- *keyboard input* of commands to the modem and data sent over a data link
- *screen output* of commands and the data received over a data link

Some type of telecommunications software is required to put a computer into Terminal Mode. The software assumes control, inhibiting the computer from processing any commands: only the keyboard, screen, and modem are active.

Some operating systems include a telecommunications program; you'll have to check your operations manual if you aren't sure. You may find, however, that it doesn't have the features you need.

Purchased communications programs such as USRobotics' TELPAC can transfer files, save incoming data to disk and the printer, and perform error detection/correction. Software phone directories store all of the key strokes required to call and log on to another system, so you only have to type a single command to place the call. TELPAC and some other packages also let you "script" command sequences to run at specified times. For example, you can have your system place a call and transfer files when you're asleep and the rates are lower.

Transmission Rate

The modem's transmission rate, 0–300, 1200, or 2400, is the number of bits (Øs and 1s) transmitted per second over the phone line. *Bits per second (bps)* and *baud rate* are often used interchangeably. 2400 bits per second, however, is the technically accurate description of the highest speed at which the Courier and similar modems transfer data.

Modems transmit the characters in a message *serially,* or bit by bit, as you saw in Figure A.1. The transmission is *asynchronous,* meaning there may be varying time lapses between each character's transmission. In order for the receiving modem to know when to begin collecting bits (signals) that form a character, the Courier prefixes a Start bit to the stream. To let the receiving modem know that a full character has been received, it affixes a Stop bit as well. The mo-

dem may also attach an optional *parity* bit before the Stop bit, for error-detection. (Parity is explained in the Glossary.)

Figure A.2 shows, for example, how a modem might first transmit the character A and then the character N. There are seven bits per character. Each character's bit stream is preceded by a Start bit and trailed by a parity bit and Stop bit.

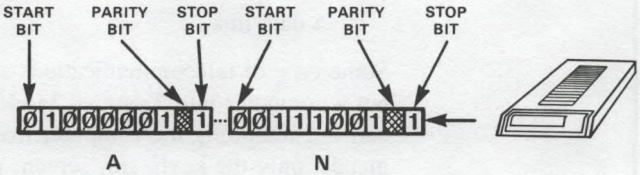


Figure A.2—Serial Transmission

The example is fairly typical—each transmission of a character takes a total of ten (10) bits. While 10 bits per character is not universal, it is a rule-of-thumb standard for calculating the number of characters transmitted per second (cps), by dividing the bit rate by 10.

For example, typical transmission speeds are 300 and 1200 bits per second (bps). When your modem operates at 300 bps, it transmits 30 characters per second. If you transmit at 1200 bps, you send 120, four times that number. At 2400 bps, the number of characters per second doubles again, to 240.

Most users prefer the fastest rate, as it cuts down on line charges. Some information services, though, have a surcharge for 1200 and 2400 bps, and in some instances the higher rate may not be economical. Higher speeds generally are cost-beneficial if you're connecting to exchange data files, but not if your connect-time is mainly spent, for example, waiting for a mainframe to do a database search. You'll need to experiment.

In any event, your rate is always determined by the rate(s) accepted by the system you're calling.

NOTE: In addition to operating at the same rate, both systems must be in agreement on word length (length of characters without the Start, Stop bits), whether or not there should be a parity bit and what type (none/odd/even), and the number of Stop bits, 1 or 2. You need to have this information before you call.

Local Echo

Incoming (received) data is always automatically output to the screen. Local echo refers to the modem's display of your input: commands sent from the keyboard or other information the modem is transmitting. There are two types of local echo setting, one when the modem is in Command Mode and the other when it is online, i.e., connected via the phone line to another system.

Command Mode Local Echo

When you power on the Courier it is in Command Mode, ready to respond to instructions from the keyboard. The modem is factory set to local echo ON; when you first power it on, it displays your commands. This power-on default is controlled by switch 4 on the bottom of the modem. If you set the switch DOWN, the modem defaults to local echo OFF when turned on or reset.

During modem operations, you'll find it more convenient to control local echoing with commands. E0 turns the echo OFF. E1 turns it back ON. Instructions for using these commands are in Chapters 2 and 3.

Some users prefer the echo OFF. Others want to see what they type and make any necessary corrections before sending commands to the modem.

NOTE: If you use a computer, your communications software may also have a Command Mode local echo setting. If both modem and software are set to local echo ON, you'll get double characters on the screen. Changing the setting of either the modem or software solves this problem.

Online Local Echo

This local echo applies when the modem has established a connection with another modem. If the echo is ON, the modem displays the data it is sending.

Most receiving systems return a copy of the data you've sent, which the modem outputs to your screen. This is referred to as *remote echo;* it gives you a chance to check the information the remote system has received.

If the remote system echoes your transmitted data and your online local echo is also ON, double characters appear on the screen. For this reason, the Courier defaults to online local echo OFF. However, if the remote system doesn't send a copy of your data, you may wish to turn your local echo ON to monitor what the Courier is transmitting. The com-

mand used to do this is F0. You'll find detailed command-use instructions in Chapter 3.

Half/Full Duplex

In microcomputer communications, the online local echo condition is often referred to as either Half Duplex (ON) or Full Duplex (OFF). These descriptions can be misleading.

Duplex denotes a communications channel that carries signals in both directions. A *half duplex* channel carries signals in both directions, but in only one direction at a time. An example is a CB radio channel. A *full duplex* channel, on the other hand, carries signals in both directions at the same time. An example is the standard dial-up telephone line. While the parties at both ends of the phone link usually don't speak at the same time, the phone line is capable of carrying their voice signals in both directions simultaneously.

The Courier is a full-duplex device, designed to work on dial-up lines. If a remote system optionally sends a remote echo of the data it receives from your modem, then operations are *full duplex:* both systems are sending and receiving at the same time. But keep in mind that your modem's online local echo setting has no control over this. The online local echo only controls whether or not the Courier copies your data to the screen as it is transmitted.

If you find half/full duplex references in documentation or in conversations with other users, you may want to distinguish whether the terms are used to describe channel operations or Online local echo status.

Standards and Compatibility

Standard interfaces between devices or systems evolve because users need compatibility and safety among products from different manufacturers. One of the most familiar is the modular plug/phone cord that comes with the Courier, for connecting the modem to the telephone system. Another standard is the ASCII character code, which can be thought of as a common computer alphabet.

Modems basically share four interfaces: modem-to-electrical power source, modem-to-computer, modem-to-phone line, and modem-to-modem (via the telephone network). The Courier's electrical interface includes an adapter that plugs into a standard 115V receptacle. For the remaining interfaces, the Courier adheres to the standards observed by almost all U.S. manufacturers of similar modems.

Modem-to-Computer/Terminal: RS-232C. The RS-232C standard assigns the signaling functions of the pins on the plugs connecting the modem to the computer or terminal. The standard was defined by the U.S. Electronic Industries Association. For more specific information on this standard, see Appendix B-1.

Modem-to-Phone Line: RJ11C (RJ12C, RJ13C). In most installations, the Courier connects with the switched network of the telephone company via the common, modular RJ11C phone connector. If the modem is on an extension and shares the phone line with other extensions, as in analog PBX or similar installations, other standard connectors are used. (Appendix E-4 has operating instructions for the latter type of installation.)

Modem-to-Modem: V.22bis, Bell 212A, Bell 103. When one modem calls another, they first exchange predefined signals that negotiate data rate, type of modulation, which one uses which frequency band, etc. The signaling sequence also includes some modem-to-telephone network details.

Together the signals form a ''handshaking protocol'' which both modems must strictly observe. Then, when the call is established and a modulation agreed upon, the modems enter a data transmission phase.

In the U.S., most manufacturers observe the same standards. The standard at 2400 bps is the CCITT recommendation V.22*bis*. The initials CCITT represent the French name of the governing body; in English it's known as the International Telegraph and Telephone Consultative Committee. At 1200 and 0–300 bps, the standard protocols are the same as those developed by Western Electric, Bell and AT&T. They are commonly referred to as Bell 212A (for 1200 bps) and Bell 103 (for 300 bps). The Bell 212A standard is observed internationally as CCITT V.22.

In addition to the above standards, the Courier uses the popular ''AT'' command set, a control protocol for ''smart'' modems. The command set is said to be a *de facto standard,* meaning it is generally acknowledged as the standard but not formally endorsed by any legal or industrial body. Modems must also be certified by the FCC (U.S.) and DOC (Canada), as described on pages viii–x of this manual, since they

use the telephone network and may affect radio or television reception.

Adherance to these standards assures you that the Courier will operate with the majority of asynchronous dial-up modems on the market.

NOTE: The observance of international standards doesn't mean you can use the Courier to call the home office from a Paris hotel room, for many of the same reasons that you can't plug in a U.S.-made electric shaver or hair dryer. U.S.-made dial-up modems must be modified to work on the telephone system of any country outside of Mexico, Canada and the U.S.

Now that you are familiar with some telecommunications basics, proceed to Chapter 2 to find out how to get the modem up and operating.

APPENDIX B
SUMMARIES AND TABLES

CONTENTS

B-1 The RS-232C Interface, with Pin Definitions

B-2 Front End Indicators

B-3 DIP Switch Summary

B-4 Courier Settings for Selected Telecommunications Software

B-5 S-Register Summary

B-6 ASCII Chart

APPENDIX B-1
THE RS-232C INTERFACE, WITH PIN DEFINITIONS

DESCRIPTION

The RS-232C interface (often referred to without the "C") is a standard developed by the Electronic Industries Association (EIA). It defines the signals and voltages used when data is exchanged between a computer or terminal and a modem or serial printer. Data is transmitted between the devices via a cable with (typically) 25-pin connectors.

PIN ASSIGNMENTS

The entire standard covers many more functions than are used in most data communications applications. The pin assignments that are factory set in the Courier 1200 are shown in the following table.

RS-232C INTERFACE PIN DEFINITIONS

PIN	ASSIGNMENT	SIGNAL FLOW
2	Transmit Data	Terminal → Modem
3	Receive Data	Terminal ← Modem
5	Clear to Send	Terminal ← Modem
6	Data Set Ready	Terminal ← Modem
7	Signal Ground	Terminal ↔ Modem
8	Carrier Detect	Terminal ← Modem
12	Speed Indicate	Terminal ← Modem
20	Data Terminal Ready	Terminal → Modem
22	Ring Indicate	Terminal ← Modem

NOTE: Some computer/terminal equipment supports only a few of the RS-232C signal functions set in the Courier. *The minimum required for the modem to operate are Pins 2, 3, and 7, plus the Data Terminal Ready (DTR) Override switch (DIP switch 1) ON.* If the DTR override is OFF, Pin 20 is also required.

APPENDIX B-2
FRONT END INDICATORS

Symbol	Meaning	Status
HS	High Speed	ON when the Courier 2400 is powered on or communicating with another modem at 2400 bps. Flashes during retrain sequence.
AA	Auto Answer/ Answer	ON when the Courier is in Auto Answer Mode and when online with a calling modem.
CD	Carrier Detect	ON when the Courier receives a valid data signal (carrier) from a remote modem. Indicates that data transmission is possible.
OH	Off Hook	ON when the Courier takes control of the phone line to establish a data link.
RD	Receive Data	Flashes when a data bit is received by the Courier from the phone line, or when the modem is sending result codes to the terminal or computer.
SD	Send Data	Flashes when a data bit is sent to the Courier by the terminal or computer.
TR	Terminal Ready	ON when the modem receives a Data Terminal Ready signal from the terminal or computer (via RS-232C Pin 20), or when the DTR override (DIP switch 1) is ON (DOWN).
MR	Modem Ready/ Power	ON when the Courier is powered on.
AL	Analog Loopback	On when the Courier is in Analog Loopback Self-Test Mode.

APPENDIX B-3
DIP SWITCH SUMMARY

PURPOSE

The Courier's DIP switches, located in the well on the bottom of the modem case, are for adapting the modem to you equipment and personal requirements. Appendix B-4 is a listing of switch settings for many popular communications software programs. You may also want to experiment and review your computer or terminal documentation as necessary.

Some users are able to move a single switch with a finger tip. If this doesn't work for you, use a toothpick or other small instrument.

OPERATIONS

The DIP switch settings are power-on defaults, read by the Courier when it is turned on or reset with the ATZ command. In some cases (switches 2, 3, 4, 5), corresponding commands can be used to change the settings during modem operation. If you change switch 2–5 or 9 when the modem is on, issue the ATZ command to initiate the new setting.

DIP SWITCHES: UP = OFF (OPEN), DOWN = ON (CLOSED)

Switch	Factory Setting	Function
1	DOWN	Data Terminal Ready Override UP DTR normal; RS-232C Pin 20 controls modem DOWN DTR always ON (override)
2	UP	Verbal/Numeric Result Codes UP Verbal (word) messages DOWN Numeric codes
3	DOWN	Result Code Display UP Quiet mode, no display DOWN Result codes displayed
4	UP	Command Mode Local Echo UP Keyboard commands displayed DOWN Display of keyboard commands suppressed
5	DOWN	Auto Answer UP Modem answers on first ring DOWN Auto Answer suppressed

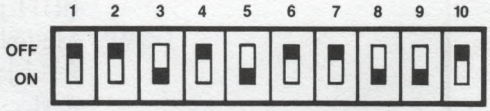
Switch	Factory Setting	Function
6	DOWN	Carrier Detect Override UP RS-232C Pin 8 indicates when modem is online and a carrier data signal is present DOWN Carrier Detect signal always ON (override)
7	UP	Single/Multiple Phone Installation UP Single phone line connection (RJ11 jack) DOWN Multiple phone installations (RJ12 or RJ13 jack); shorts A/A1 to notify other devices when modem goes off hook and line is busy
8	DOWN	"AT" Command Set Recognition UP Command set recognition disabled (Dumb Mode) DOWN Normal operations (Smart Mode)
9	DOWN	Escape Code (+ + +) Operations/Data Format Smart Mode (Default): UP When escape code is sent, modem hangs up, returns to Command Mode, displays NO CARRIER DOWN When escape code is sent, modem retains connection, returns to Command Mode, displays OK Dumb Mode: UP 11-bit transmission DOWN 10-bit transmission
10	UP	Reserved for future use
Quad Switch	UP	RS-232C Modem/Terminal Interface UP Normal assignments, Pins 2 & 3: terminal to modem, Pin 2; modem to terminal, Pin 3 DOWN Alternate assignments, Pins 2 & 3: terminal to modem, Pin 3; modem to terminal, Pin 2 *The need to change this setting is rare. Carefully review your computer or terminal documentation before turning this switch ON.*

APPENDIX B-4
COURIER SETTINGS FOR SELECTED TELECOMMUNICATIONS SOFTWARE

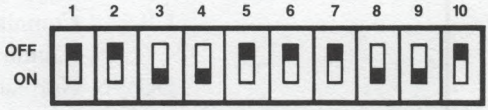
Listed below are suggested DIP switch settings for a number of popular telecommunications software packages. The Quad switch is not included since its setting is determined by terminal/computer circuitry, independent of software.

The Courier's DIP switches are located in the well on the bottom of the modem. A summary of the switch functions and factory settings is in Appendix B-3.

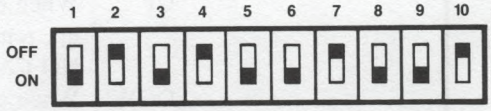
1. TELPAC 3.x
   USRobotics, Inc.



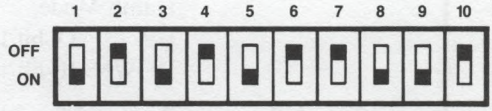
2. Crosstalk XVI
   MicroStuf, Inc.



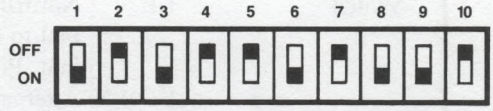
3. PC-Talk III
   Freeware, Headlands Press



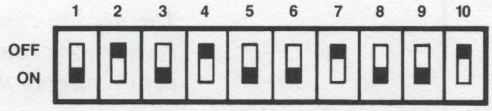
4. SmartCom 2.x *
   Hayes Microcomputer Products, Inc.



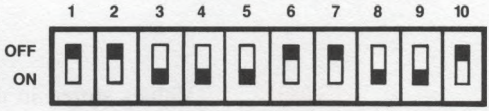
5. ASCOM
   Dynamic Microprocessor Ass'n.



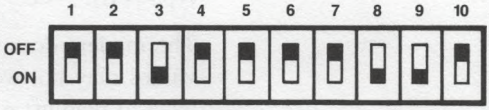
6. Data Capture/PC
   Southern Software



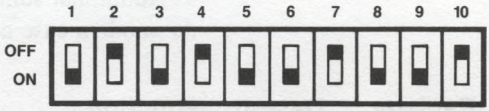
7. Telios
   Genasys



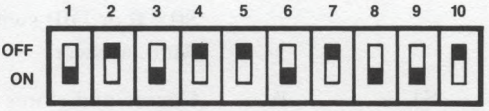
8. MITE
   Mycroft Labs, Inc.



9. SmartTerm
   Persoft



10. BLAST
    Communications Research Group



* Smartcom 2.0 does not support 2400 bps operations. (Version 2.1 was designed for 2400 bps operations.) You can still use Smartcom 2.0 with the Courier for 300/1200 bps communications, however, if you make a slight modification to one of the Courier's settings.

When the Courier's product code inquiry (ATIØ) is issued, Smartcom 2.0 expects the modem to return a code of 12*n*. When the Courier sends its code of 24*n*, Smartcom 2.0 interprets it as meaning 300 bps only.

Use the S14 register to change the Courier's response, so you can enable normal 300/1200 bps operations.

1. When you first load Smartcom 2.0, issue this command:

   ATS14=12Ø <cr>

2. Exit Smartcom.

3. Reenter Smartcom.

NOTE: The reset command (ATZ) does not affect the S14 setting, but the above steps must be followed each time you power on the Courier.

APPENDIX B-5
S-REGISTER SUMMARY

USAGE

Values stored in the S-registers are changed with the ATS*r*=*n* command, where *r* is the register and *n* is a decimal value from Ø–255. To query the status of a register, type ATS*r*? <cr>

The modem does not perform a value-range check. Some values may not work with some equipment and you may have to readjust a setting.

For more information on using the S-registers, see Chapter 3. Additional summaries are on the label on the bottom of the modem case and in the Quick-Reference Card.

Register	Default	Function
SØ	See Dip Switch 5	Sets the number of rings on which to answer when in Auto Answer Mode. Default = 1, equivalent of DIP switch 5 UP. SØ = Ø or DIP switch 5 DOWN (factory setting) suppresses Auto Answer.
S1	Ø	Counts and stores the number of rings from an incoming call.
S2	43	Holds the ASCII decimal code for the escape code character. Default character is "+". A value of 128–255 disables the escape code.
S3	13	Holds the ASCII decimal code for the character recognized as Carriage Return.
S4	1Ø	Holds the ASCII decimal code for the character recognized as Line Feed.
S5	8	Holds the ASCII decimal code for the character recognized as Backspace.
S6	2	Sets the number of seconds the modem waits before dialing. If set to X2, X4, or X6, the modem ignores this register and dials as soon as it detects a dial tone (fast dials).

Register	Default	Function
S7	30	Sets the number of seconds the modem waits for a carrier. May be set for much longer duration if, for example, the modem is originating an international connection.
S8	2	Sets the duration, in seconds, for the pause (,) option in the Dial command and the pause between command reexecutions for the Repeat (>) command.
S9	6	Sets the required duration, in tenths of a second, of the remote modem's carrier signal before recognition by the Courier (Carrier Detect Time).
S10	7	Sets the duration, in tenths of a second, that the modem waits after loss of carrier before hanging up.
S11	70	Sets the duration and spacing, in milliseconds, of dialed Touch-Tones.
S12	50	Sets the duration, in fiftieths of a second, of the guard time for the escape code sequence.
S13		Bit-mapped register. Reserved.
S14		Stores product code returned at ATI0.
S15		Reserved.
S16	0	Modem self-test. See Chapter 2 for test procedures.

APPENDIX B-6
ASCII CHART

ASCII CHART											
DEC	HEX	CHAR	DEC	HEX	CHAR	DEC	HEX	CHAR	DEC	HEX	CHAR
00	00	NUL	32	20	SP	64	40	@	96	60	`
01	01	SOH	33	21	!	65	41	A	97	61	a
02	02	STX	34	22	"	66	42	B	98	62	b
03	03	ETX	35	23	#	67	43	C	99	63	c
04	04	EOT	36	24	$	68	44	D	100	64	d
05	05	ENQ	37	25	%	69	45	E	101	65	e
06	06	ACK	38	26	&	70	46	F	102	66	f
07	07	BEL	39	27	'	71	47	G	103	67	g
08	08	BS	40	28	(	72	48	H	104	68	h
09	09	HT	41	29	)	73	49	I	105	69	i
10	0A	LF	42	2A	*	74	4A	J	106	6A	j
11	0B	VT	43	2B	+	75	4B	K	107	6B	k
12	0C	FF	44	2C	,	76	4C	L	108	6C	l
13	0D	CR	45	2D	–	77	4D	M	109	6D	m
14	0E	SO	46	2E	.	78	4E	N	110	6E	n
15	0F	SI	47	2F	/	79	4F	O	111	6F	o
16	10	DLE	48	30	0	80	50	P	112	70	p
17	11	XON	49	31	1	81	51	Q	113	71	q
18	12	DC2	50	32	2	82	52	R	114	72	r
19	13	XOFF	51	33	3	83	53	S	115	73	s
20	14	DC4	52	34	4	84	54	T	116	74	t
21	15	NAK	53	35	5	85	55	U	117	75	u
22	16	SYN	54	36	6	86	56	V	118	76	v
23	17	ETB	55	37	7	87	57	W	119	77	w
24	18	CAN	56	38	8	88	58	X	120	78	x
25	19	EM	57	39	9	89	59	Y	121	79	y
26	1A	SUB	58	3A	:	90	5A	Z	122	7A	z
27	1B	ESC	59	3B	;	91	5B	[	123	7B	{
28	1C	FS	60	3C	<	92	5C	\	124	7C	|
29	1D	GS	61	3D	=	93	5D	]	125	7D	}
30	1E	RS	62	3E	>	94	5E	^	126	7E	~
31	1F	US	63	3F	?	95	5F	_	127	7F	DEL

APPENDIX C
ALPHABETICAL COMMAND SUMMARY

The commands listed here are explained in detail in Chapter 3, "Operating the Courier 2400."

Type commands in upper or lower case. All commands other than A/ (reexecute the previously entered command) and the + + + escape code must be preceded by AT and will not be executed until you enter a carriage return (press the Enter key).

Command length = 40 characters maximum. The modem doesn't count the AT prefix, Carriage Return character, or spaces. It counts but doesn't act on punctuation such as hyphens and parentheses. A missing numeric parameter is assumed to be zero, as in the command to hang up: ATH is the equivalent of ATH0.

Command/ Options	Function
A	Force Answer Mode when the modem hasn't received an incoming call.
A/	Reexecute the last command: the modem buffers each command until the next command is entered. This command does not take the AT prefix or a Carriage Return. Useful for redialing.
Any Key	Terminate current dialing operation resulting from an issued Dial command; terminate repeat command (>) execution.
AT	Attention: lets the modem know that commands are being issued to it. *Must* precede all other commands, except A/ and + + +.
C*n*	Transmitter enabled/disabled.
C0	Transmitter disabled; RECEIVE ONLY condition of additional modem sharing phone line.
C1	Transmitter enabled (Default). Normal operation in which only one modem is connected to phone line.

Command/ Options	Function
D	Dial the number that follows and go into Originate Mode. The following options may be used:
P	Pulse dial (Default).
T	Touch-Tone dial.
,	(Comma) Pause for 2 seconds.
;	After dialing, return to command state.
"	Dial the letters that follow.
!	Transfer call (flash switch-hook).
W	Wait for second dial tone (X3 or higher).
@	Wait for an answer (X3 or higher).
R	Reverse frequency.
E*n*	Command Mode Local Echo ON/OFF.
E0	Echo OFF.
E1	Echo ON. Modem echoes to the screen (displays) all commands you send it from the keyboard. (Not applicable once a connection has been made.) See DIP switch 4.
F*n*	Online Local Echo ON/OFF.
F0	Local Echo ON. Also called Half Duplex. Modem sends copy of data it transmits to your screen.
F1	Local echo OFF (Default). Also called Full Duplex. Remote computer may send a copy of data it receives to your screen, resulting in remote echo.
H*n*	On/off hook control.
H0	Hang up (go on hook).
H1	Go off hook.

Command/ Options	Function
I*n*	Inquiry.
I0	Return product code.
I1	Return memory (ROM) Checksum.
I2	Run memory (RAM) test.
I3	Return call duration or real time (see K*n*).
I4	Return current modem settings.
K*n*	Modem clock operation: Call-duration or Real-time Mode.
K0	Return call duration at ATI3 (Default).
K1	Return actual time at ATI3. Clock is set using ATI3 = HH:MM:SS K1.
M*n*	Monitor (speaker) control.
M0	Speaker always OFF.
M1	Speaker ON until carrier is established (Default).
M2	Speaker always ON.
M3	Speaker ON after last digit dialed and until carrier is established.
O	Return online after command execution.
P	Pulse dial (Default).
Q*n*	Quiet Mode: modem result codes displayed/suppressed.
Q0	Result codes displayed (Default).
Q1	Result codes suppressed—useful when the messages might interfere with the data stream.
S*r*=*n*	S-register commands: *r* is any S-register; *n*-value must be a decimal number between 0 and 255.
S*r*?	Query register *r*.
T	Tone dial.

Command/ Options	Function
V*n*	Return result codes in words or numbers (Verbal/Numeric Mode).
V0	Numeric Mode.
V1	Verbal Mode (Default).
X*n*	Result Code options. Use the following table. (Default is Extended set, codes 0–5, 10.)

RESULT CODES OPTIONS TABLE

	COMMANDS						
	X0	X1	X2	X3	X4	X5	X6
RESULT CODES							
0/OK	X	X	X	X	X	X	X
1/CONNECT	X	X	X	X	X	X	X
2/RING	X	X	X	X	X	X	X
3/NO CARRIER	X	X	X	X	X	X	X
4/ERROR	X	X	X	X	X	X	X
5/CONNECT 1200		X	X	X	X	X	X
6/NO DIAL TONE			X		X		X
7/BUSY				X	X	X	X
8/NO ANSWER (Requires @; replaces NO CARRIER)				X	X	X	X
9/Reserved for future use							
10/CONNECT 2400		X	X	X	X	X	X
11/RINGING						X	X
12/VOICE						X	X
FUNCTIONS							
Adaptive Dialing			X	X	X	X	X
Wait for 2nd Dial Tone (W)				X	X	X	X
Wait for Answer (@)				X	X	X	X
Fast Dial			X		X		X

Z	Reset the modem to its default values; initiate new settings of DIP switches 2–5, 9.

Command/ Options	Function
+ + +	Escape code sequence, preceded and followed by at least one second of no data transmission: modem terminates transmission to remote modem and, depending on setting of DIP Switch 9, does the following: Switch 9 DOWN (ON)—modem retains the phone line connection, returns to Command Mode, sends OK result code. Switch 9 UP (OFF)—modem disconnects (hangs up), returns to Command Mode, and sends NO CARRIER result code.
>	Repeat command.
$	Help command summary request.
D$	Help Dial command summary request.
S$	Help S-register summary request.
Morse Code	See Chapter 3 for more information.
.	Dot character.
–	Dash character.
/	Inter-character space.

APPENDIX D
PROBLEMS AND SOLUTIONS

You may occasionally encounter one of the problems listed here. They are divided into two categories: before and during the exchange of user information over the data link.

PROBLEM	SUGGESTED SOLUTION
Before Establishment of the Data Link	
Your modem . . .	
Doesn't answer the phone or go "off hook" to dial a number	Check to make sure your computer or terminal is providing a positive voltage on pin 20 of the RS-232C plug. ➤ See Appendix B-3, DIP Switch 1.
Doesn't respond OK when you type AT <cr>	1. If you are using a computer, make sure it is in Terminal Mode. Be sure to type in either upper or lower case, not a combination, and to type a Carriage Return. 2. Check to make sure that your software or terminal is set to the correct bit rate, word length (7 bits plus one parity bit or 8 bits and no parity), and communications port. 3. Check to see if DIP switch 6 is correctly set for your equipment. ➤ See Appendix B-3. 4. If your equipment requires an 11-bit format, review Appendix E-3. 5. Check to see that your computer or terminal is sending on pin 2 of the RS-232C connector. ➤ See Appendix B-3, Quad Switch, and your equipment documentation.

PROBLEM	SUGGESTED SOLUTION
Before Establishment of the Data Link	
Your computer . . .	
Reacts as if a data link has been established when no call has actually been received	Check to see if DIP Switch 6 is ON. If so, turn it off because the system may be reacting to improper signals received on pin 8 of the RS-232C connector.
In answer mode, acts as if a carriage return had been returned, but nothing has been typed at the keyboard	Your software may be misreading signals from your modem as it automatically sends a <cr> and a line feed before and after the RING and CONNECT messages. Entering the Quiet mode command, ATQ1 <cr>, should solve the problem.
Both modems . . .	
Exchange carrier signals, but fail to establish a communications link	1. Check to make sure the proper bit rate, word length, parity, and number of stop bits have been selected. 2. If that doesn't correct the problem, it's likely that the quality of the phone connection is poor and that the other modem is missing the tones your modem is transmitting. Because of the variable quality of phone line connections, data transmission is sometimes difficult. Try several calls, and if you still can't get through, try using a different service. 3. If you still have problems, try calling another modem. If the second modem accepts your call, the problem lies with the modem you first tried to dial. 4. Make sure that the modem at the other end of the line is V.22*bis*-compatible at 2400 bps, Bell 212A- compatible at 1200 bps, or Bell-103-compatible at 300 bps. These are the common signaling standards for full duplex dial network transmission in the U.S. However, it is possible that the modem at the other end is not compatible with these standards.

PROBLEM	SUGGESTED SOLUTION
During data transfer	
Your screen displays . . .	
Only brackets	Check to make sure both modems are at the same bit rate, word length, parity, and number of Stop bits. Chances are that you are transmitting at 1200 or 2400 bit and there is a problem on the phone line. Try the following measures: 1. Try placing the call again. The phone company routes even local calls differently each time you call. 2. Try calling a different modem to see if the problem persists. (However, if it does, the problem may still be with the phone line.) 3. If you are using a long-distance service and the problem persists, you might try calling over a different service.
Random (garbage) characters	1. Make sure both modems are set at the same bit rate, parity, word length, and number of Stop bits. 2. You may be calling an 11-bit computer. ➤ See Appendix E-3.
Double characters	The modem's online echo is ON. When convenient, return the modem to Command Mode (+++). Then type: ATF1 <cr>

If You Still Have Problems

The problems described above are by far the most common ones that users encounter with the modem. If the suggestions we've given won't clear up your difficulties, try the following:

1. Review the manual carefully to see if you've missed something.
2. Call or visit your dealer. Chances are your dealer will be able to give you the assistance you need. This is much more efficient and time-saving than returning the modem to USRobotics.

3. If your dealer can't clear up your difficulties, call the USRobotics Technical Support Department at 800/982-5151 (in Illinois, 312/982-5151). Our Service Representatives will be happy to give you assistance over the phone Monday through Friday from 8:30 a.m. to 5 p.m. (Central Time Zone).
4. If necessary, the Service Representative you talk to may give you a Returned Materials Authorization (RMA) number. *Modems without an RMA number will not be accepted.*
5. If you do return the modem to us, please follow this procedure—
   a. Ship the unit, postage paid, in its original container. If the original container is not available, pack the modem carefully in a strong box of corrugated cardboard with plenty of packing material.
   b. Be sure to include your RMA number inside the package, along with your name and address. *Put your return address and your RMA number on the shipping label as well.*
   c. Ship the well-packed modem to the following address.

      Technical Support Department
      USRobotics, Inc.
      8100 North McCormick Boulevard
      Skokie, Illinois 60076

   d. Please note that USRobotics will not accept packages sent COD, so be sure to send the modem postage paid.
   e. If you follow these directions, USRobotics will repair your modem and send it back to you via United Parcel Service.

APPENDIX E
ADDITIONAL OPERATIONAL INFORMATION

CONTENTS

E-1 Using Both Voice and Data Communications

E-2 High Speed/Low Speed Protocol

E-3 10/11-Bit Transmission

E-4 PBX, Dedicated Line, and Leased Line Operations

APPENDIX E-1
USING BOTH VOICE AND DATA COMMUNICATIONS

VOICE/DATA CALLING

"Assembling the Courier 2400," in Chapter 2, shows how you can keep your phone connected to your system by connecting the phone to the second jack in the modem. If you do this, you can use the phone to synchronize communications with another computer user whose modem uses the AT command set, such as a USRobotics or USRobotics-compatible modem.

Preparation

First call the other user to establish the bit rate, parity, word length, and number of Stop bits that the other person's modem accepts. Then both of you can turn the call over to your modems.

Commands

Follow these steps to turn control over to your modem.

1. Without hanging up the phone, have your modem go off hook in Originate Mode. Type the following command:

   ATD <cr>

   NOTE: Be sure the modem is *not* set to X2, X4, or X6, or it will return the NO DIAL TONE result code and hang up.

2. The other party should then put the remote modem into Answer Mode. The following command is used to do this:

   ATA <cr>

3. Now both of you can hang up your respective phones, while the two modems establish the data link. They will maintain the link until one of you gives your modem a command to disconnect.

Either party's device can be the originate or answer modem: it doesn't matter who placed the original voice phone call. But one modem must first enter Originate Mode and the other then enter Answer Mode. You and the other party, therefore, must agree on which command, ATD or ATA, you will each use.

NOTE: It may happen that spurious "garbage" characters will appear on the screen when you hang up the phone. You can avoid these by hanging up the phone as soon as you hear the modem go off hook, during the one or two seconds it takes the two modems to establish the link.

APPENDIX E-2
HIGH SPEED/LOW SPEED PROTOCOL

OVERVIEW

A calling modem is conventionally said to be in *originate* mode, while the called modem is said to be in *answer* mode. In originate mode, the Courier 2400 operates at the bit rate your computer or terminal uses to give it commands. In answer mode, however, the Courier 2400 adjusts itself to the rate of the incoming call and signals the terminal or computer to adjust if there is a rate change. In addition, if the Extended result code set is in effect, or one of the advanced options (➤ Chapter 3, Appendix C), the Courier 2400 must send the appropriate result code to the computer or terminal screen: CONNECT, CONNECT 1200, or CONNECT 2400.

The modem sends these responses to the computer or terminal at the bit rate it has been operating under, and then changes to the new bit rate. If you've just powered up the modem, it defaults to 2400. The example and description on the next page demonstrate how the adjustments take place.

If you're using a computer and telecommunications software, you may find that your computer doesn't respond to the modem's signals, and therefore fails to adjust to the new rate. If you use USRobotics' TELPAC software, and your system is in Remote Access or Host mode, the software has the ability to understand at which speed a call is coming through, and the computer automatically switches to the new rate. However, this may not be the case with other software.

If your computer doesn't respond automatically to incoming calls at different bit rates, you may be able to program it to do so. Make sure the modem is set to X1 or higher so it indicates 300, 1200, and 2400 bps calls. Use the example on the next page as a guide. It assumes that the default Extended result code set is in effect. The outline of operations is followed by a detailed explanation.

Example

Action	Courier 2400 Response	Bit Rate
1. Power on.		2400
2. 300-bps call comes in.	RING CONNECT	2400 2400
3. Data link is established. Data transfer takes place.		300
4. Data session is over. Call is ended; loss of carrier.	NO CARRIER	300
5. 1200-bps call comes in.	RING CONNECT 1200	300 300
6. Data link is established. Data transfer takes place.		1200
7. Data session is over. Call is ended; loss of carrier.	NO CARRIER	1200
8. 2400-bps call comes in.	RING CONNECT 2400	1200 1200
9. Data link is established. Data transfer takes place.		2400
10. Data session is over. Call is ended; loss of carrier.	NO CARRIER	2400

Explanation

1. The modem is powered on. By default it operates at 2400 bits per second (bps).

2. A remote terminal or computer with a 300-bps modem calls. The Courier 2400 senses the incoming signal and flashes the messages RING and CONNECT to the computer. These messages are sent at 2400 bps since the modem was operating at 2400 bps when it was activated.

3. Since the Courier 2400 responds CONNECT, rather than CONNECT 2400 or CONNECT 1200, the computer adjusts accordingly. The modem automatically shifts to 300 bps to accept the data from the incoming call.

4. The data session is terminated, and the modem sends the message NO CARRIER at 300 bps.

5. A 1200-bps call comes in. The modem responds RING and CONNECT 1200. These messages are sent at the current rate, 300 bps.

6. The computer, receiving the CONNECT 1200 message, adjusts accordingly for the higher rate. The modem also shifts to 1200 bps.

7. The data session is terminated, and the modem sends the message NO CARRIER at 1200 bps.

8. When a 2400-bps call comes in, the modem responds RING and CONNECT 2400 at 1200 bps.

9. When the computer receives the message CONNECT 2400, it shifts to the higher rate. The modem also shifts to 2400 bps.

10. The data session is terminated, and the modem sends the message NO CARRIER at 2400 bps.

You can try programming your computer to respond to the result codes specifying the varying bit rates of incoming calls. Keep in mind, however, that whether or not your computer adjusts itself to these rate changes, the Courier 2400 will automatically shift to the rate of the calling modem.

APPENDIX E-3
10/11-BIT TRANSMISSION

OVERVIEW

The typical data format length is 10 bits: 7 character bits plus a parity bit, or 8 character bits with no parity bit, plus Start and Stop bits. The rare exception is the system that accepts only 11-bit transmission, that is, 8-bit characters, plus parity, Start and Stop bits.

If two Stop bits are used, the second Stop bit is *not* included in the calculation of the size of the transmission unit.

CHANGING THE FORMAT LENGTH

The Courier defaults to 10-bit transmission units:

Stop bit	1
Word length	7
Parity	1 (Even)
Stop bit	1

The Courier is factory-set for Smart Mode operation (DIP switch 8 ON) and detects the length of the data units from the AT characters sent from the computer or terminal. For 11-bit transmission, you need to set your software or terminal to a word length of 8 bits plus 1 parity bit. If you're operating the modem in Dumb Mode, you need to change the setting of DIP switch 9. Procedures are outlined below.

Smart Mode

1. Set your terminal or software to a word length of 8 bits plus 1 parity bit.
2. Type the Attention command and enter it with a carriage return:

   AT <cr>

Dumb Mode

1. DIP switch 8 = UP for Dumb mode.
2. DIP switch 9 = DOWN for 10-bit transmission
   UP for 11-bit transmission.
3. Reset the modem to initiate the switch settings by powering it OFF and ON. Then set your terminal or software for 11-bit transmission.

NOTE: Although the modem will successfully transmit 11-bit units, you may still find that your terminal/computer cannot understand them. This varies among systems: it's best to experiment. Consult your equipment documentation for details.

APPENDIX E-4
PBX, DEDICATED LINE, AND LEASED LINE OPERATIONS

The following operations apply in installations where the modem is not directly connected to the public-access switched telephone network.

PBX Installations

It's possible to install the modem(s) on the customer side of an analog PBX. When used with multiple telephones per line, DIP switch 7 can be set DOWN to short A/A1 when the modem is off hook. This notifies other devices sharing the line that the line is busy.

Calling an Outside Party

To have the modem make an outside call, follow the auto-dial instructions in Chapter 3, but insert the sequence used to obtain an outside line, followed by a comma, before the phone number in the Dial command.

The off-hook indicator on the PBX should show the extension as busy if DIP switch 7 is DOWN.

Internal Calling

To call another modem on the PBX system, call the extension of the destination modem. It should automatically answer on the incoming ring.

The off-hook indicators on the PBX should show both extensions as busy if DIP switch 7 is DOWN on both modems.

2-Wire Dedicated (Private) or Leased Line

A 2-Wire dedicated (private) line is a customer-installed, twisted-pair line. Leased lines are provided by the telephone company and may be designated as 3002 Analog Circuits (4-Wire) with 2-Wire to 4-Wire converters.

In both types of installation there is a continuous point-to-point connection between two modems. For optimal operations, the physical length of the line should not exceed 5 miles.

To establish the connection, follow these steps:

1. Decide which modem is to be the Originate modem, and which the Answer modem. The originate and answer frequencies must be defined for the modems to communicate.

2. First put the calling modem in Originate Mode with the manual Dial command:

   ATD <cr>

   Be sure the modem is *not* set to X2, X4, or X6 or it will return the NO DIAL TONE result code and hang up.

3. Then put the answering modem in Answer Mode with the manual Answer command:

   ATA <cr>

NOTE: If there is an interruption in the communications link (a strike to the line due to weather or some other problem), repeat steps 2 and 3 to reestablish the link.

APPENDIX F
TECHNICAL SPECIFICATIONS

Compatibility

CCITT recommendation V.22*bis*, 2400 bps, asynchronous, Quadrature Amplitude Modulation (QAM)

Bell 212A, 1200 bps, asynchronous, Differential Phase Shift Keying (DPSK)

Bell 103, 0–300 bps, asynchronous, Frequency Shift Keying (FSK)

RS-232C terminal/modem interface

Superset of Hayes 1200-modem command set, S-registers, DIP switches

Most microcomputer telecommunications software, including TELPAC, Crosstalk, PC-TALK III, Smartcom 2.x, ASCOM, Telios, MITE, BLAST, Data Capture/PC, SmartTerm, Apple Computer, Inc.'s Access II and MacTerminal

Phone Line Interface

RJ11, RJ12, RJ13, RJ41, RJ45 phone jacks

Communications Channel

Full/half duplex on 2-wire dial-up, dedicated, or leased phone lines

Data Rates

0–300, 1200, 2400 bits per second

Operational Modes

Auto Dial/Answer, Manual Originate/Answer

Dialing

Rotary (pulse) or Touch-Tone (DTMF—0–9, #, *; a-z when in Quote ['] Mode)

Command Buffer Size

40 characters, exclusive of AT prefix, Carriage Return and spaces

Data Format

Binary, serial, asynchronous:

Start Bits	Data Bits	Parity	Stop Bits
1	7	Even, Odd, Mark, Space	1
1	7	None, Even, Odd, Mark, Space	2
1	8	None, Even, Odd, Mark, Space	1,2

Front Panel Indicators

HS	High Speed (2400 bps)
AA	Auto Answer/Answer
CD	Carrier Detect
OH	Off Hook
RD	Receive Data
SD	Send Data
TR	Terminal Ready (DTR)
MR	Modem Ready/Power
AL	Analog Loopback

Programmable S-Registers

Values in parentheses are defaults:

Number of rings on which to answer (1)
ASCII character definitions, decimal: escape code (43), Carriage Return (13), Line Feed (10), Backspace (8)
Timing: Wait before dialing (2 sec)
Carrier Detect wait (30 sec)
Pause in Dial, Repeat commands (2 sec)
Remote Carrier Detect before local recognition (0.6 sec)
Disconnect at loss of carrier (0.7 sec)
Escape code guard time (1 sec)
Touch-Tone duration, spacing (70 Ms)
Modem self-testing (Ø, Data Mode)

Switch Functions

Externally accessible. Values in parentheses are factory settings: UP = OFF (open), DOWN = ON (closed).

Volume control
DTR, CD overrides (DOWN)
Result code mode (UP, verbal)
Result code display (DOWN)
Command Mode echo (UP, echo ON)
Auto Answer (DOWN, AA suppressed)
RJ11/RJ13 jack (UP, RJ11)
Smart/Dumb mode (DOWN, Smart)
10/11-bit transmission (DOWN, 10-bit)
Online Escape code with/without disconnect (DOWN, no disconnect)
RS-232C Modem/Terminal data interface (UP, normal assignments of Pins 2 and 3)

Control Commands	Toggle back online after + + +
	Command mode/online echo
	Verbal/numeric result codes
	Standard, Extended, Advanced result code sets
	Result code display ON/OFF
	Speaker OFF, ON until CD, ON through CD and data transmission, ON after last digit dialed until CD
	Voice/data communications
	Adaptive dialing
	Fast dialing, search for dial tone
	Wait for second dial tone
	Wait for answer before dialing
	Dial alphabetic string
	Flash hook to transfer call
	Reset to defaults
Test Options	Analog loopback
	Dial test
	Test pattern (1200/2400 bps)
	Analog loopback with test pattern (1200/2400 bps)
Call Progress Codes	CONNECT / NO DIAL TONE
	CONNECT 1200 / BUSY
	CONNECT 2400 / NO ANSWER
	RING / RINGING
	NO CARRIER / VOICE
Equalization	Adaptive
Transmitter Carrier Frequencies	V.22*bis*, Bell 212A
	Originate Mode: 1200 Hz ± .01%
	Answer Mode: 2400 Hz ± .01%
	Bell 103
	Originate Mode:
	Mark: 1270 Hz ± .5%
	Space: 1070 Hz ± .5%
	Answer Mode:
	Mark: 2225 Hz ± .5%
	Space: 2025 Hz ± .5%

Receiver Carrier Frequencies	V.22*bis*, Bell 212A Originate Mode: 2400 Hz Answer Mode: 1200 Hz Bell 103 Originate Mode: Mark: 2225 Hz Space: 2025 Hz Answer Mode: Mark: 1270 Hz Space: 1070 Hz
Retrain Sequence	The retrain sequence only occurs at 2400 bps. V.22*bis* specifies lowering CTS to signal the need to retrain. The Courier, not implementing CTS, sends the same information by turning the HS indicator off and lowering the RS-232C high speed signal (pin 12). 1. The Courier's receiver, sensing a need to retrain, clamps RX to MARKS, and switches the HS indicator and interface signal OFF. 2. Modem 2, after receiving about 100 Ms of analog signals (a pattern of ?˜?˜ is usually output), clamps RX data to MARKS and lowers CTS or, if it is a Courier, turns HS OFF. 3. After the training sequence, approximately one second, the Courier unclamps RX data and turns HS ON. 4. Modem 2 reenters Data Mode.
Certification	FCC Part 68 & Part 15, Subpart J, Class B Domestic; DOC (Canada)
Power Adapter	UL listed, CSA approved, Supply voltage: 120 VAC, 60 Hz, 18 VAC Output
Power Consumption	2 watts
Failed Call Timeout	30-sec. default, programmable 2–255 sec.

Answer Tone Timeout	30 sec. default, programmable 2–255 sec.
Answer Tone Detector	2150–2300 Hz
Loss of Carrier Timeout	(Disconnect Timer) 0.7-sec. default, programmable 0.2–25.5 sec.
Receive Sensitivity	–42 dBm
Transmit Level	– 9 dBm
Transmitter Frequency Tolerance	.01 %
Size	6.25 x 10.25 x 1.5 inches

Cross-references in the following definitions are printed in boldface.

Analog Loopback A modem self-test in which data from the keyboard is sent to the modem's transmitter, modulated into **analog** form, looped back to the receiver, demodulated into **digital** form, and returned to the screen for verification. Tests either the modem's originate or answer frequency.

Analog signals Continuous, varying waveforms such as the voice tones carried over phone lines. Contrast with **digital signals.**

ASCII American Standard Code for Information Interchange. A 7-bit binary code (Øs, 1s) used to represent letters, numbers, and special characters, such as $, !, and /; supported by almost every computer and terminal manufacturer. ➤ See Appendix B-6 for decimal and hexadecimal code equivalents.

Asynchronous Transmission Data transmission in which the length of the time between transmitted characters may vary. Because the time lapses between transmitted characters are not uniform, the receiving modem must be signaled as to when the data bits of a character begin and when they end. The addition of **Start** and **Stop** bits to each character serve this purpose.

Auto Answer A feature in modems enabling them to answer incoming calls over the phone lines without the use of a telephone receiver.

Auto Dial A feature in modems enabling them to dial phone numbers over the phone system without the use of a telephone transmitter.

Baud Rate The number of discrete signal events per second occurring on a communications channel. Although not technically accurate, baud rate is commonly used to mean **bit rate**.

Binary Digit A Ø or 1, reflecting the use of a binary numbering system (only two possible values). Used because the computer recognizes either of two states, OFF or ON. Shortened form of binary digit is "bit."

Bit Rate The number of **binary digits** transmitted per second **(bps).** Communications channels using telephone channel modems are established at set bit rates, commonly 110, 300, 1200, 2400, 4800, 9600, and 14400. Full duplex dial-up modems today commonly transmit at 300, 1200, or 2400 bps.

BPS The bits (**binary digits**) per second rate.

Byte A group of **binary digits** stored and operated upon as a unit. A byte may have a coded value equal to a character in the ASCII code (letters, numbers), for example, or have some other value meaningful to the computer. In user documentation, the term usually refers to 8-bit units or characters. 1 kilobyte = 1,024 bytes or characters; 64k = 65,536 bytes or characters.

Carrier A continuous frequency capable of being either modulated or impressed with another information-carrying signal. Carriers are generated and maintained by modems via the transmission lines of the telephone companies.

Character A representation, coded in **binary digits**, of a letter, number, or other symbol.

Characters Per Second A data transfer rate estimated from the baud rate and the character length. For example, at 1200 bps, 8-bit characters with Start and Stop bits (for a total of ten bits per character) will be transmitted at a rate of approximately 120 characters per second (cps).

Data Communications A type of communications in which computers and terminals are able to exchange data over an electronic medium.

Dedicated Line A user-installed telephone line used to connect a specified number of computers or terminals within a limited area, for example, one building. The line is a cable rather than a public-access telephone line.

Default Any setting assumed, at startup or reset, by the computer or terminal and attached devices, and operational until changed by the user.

Digital Signals Discrete, uniform signals. In this manual, the term refers to the **binary digits** Ø and 1.

Direct Connection A cable connection between two computers or terminals that enables data transfer between the machines without a modem or phone line.

Duplex Indicates a communications channel capable of carrying signals in both directions. ➤ See **Half Duplex**, **Full Duplex**.

Equalization A compensation circuit designed into modems to counteract certain distortions introduced by the telephone channel. Two types are used: fixed (compromise) equalizers and those that adapt to channel conditions.

Error Checking A software operation whose purpose is to detect transmission errors. May take a variety of forms of checking characters or blocks of data. ➤ See **Parity**.

Full Duplex Signal flow in both directions at the same time. In microcomputer data transmission, may refer to the suppression of the online **Local Echo**. The receiving computer may provide a **Remote Echo**.

Half Duplex Signal flow in both directions, but only one way at a time. In microcomputer data transmission, may refer to activation of the online **Local Echo**, which causes the modem to send a copy of the transmitted data to the screen of the sending computer.

Local Echo A modem feature that enables the modem to send copies of data to the computer screen. When no data link is established, and the modem is ready to accept commands, the local echo is invoked through the ATE1 command. When this command is issued, the modem sends a copy of every command you send it to your screen. To activate the local echo during a communications session, the modem should be set with ATFØ.

Modem A device that transmits/receives computer data through a communications channel such as radio or telephone lines. The Courier 2400 is a telephone channel modem that modulates, or transforms, digital signals from a computer into a form that can be carried successfully on a phone line. It also demodulates signals received from the phone line back to digital signals before passing them to the receiving computer.

Intelligent modems with built-in software, such as the U.S. Robotics modem described in this manual, simplify using phone networks for data communications.

OFF/ON Hook Modem operations which are the equivalent of manually lifting a phone receiver (taking it off hook) and replacing it (going on hook).

Parallel Transmission The transfer of data characters using parallel electrical paths for each bit of the character, for example, 8 paths for 8-bit characters. Data is stored in computers in parallel form, but may be converted to serial form for certain operations. ➤ See **Serial Transmission**.

Parity

An error-detection method that checks the validity of a transmitted character. There are several types of parity checking: the same type must be used by two communicating computers, or both may omit parity.

When parity is used, a parity bit is usually added to each transmitted character. The bit's value is 0 or 1, to make the total number of 1's in the character even or odd, depending on whether Even or Odd parity is used.

Protocol

A system of rules and procedures governing communications between two or more systems. Protocols vary, but communicating devices must follow the same protocol in order to exchange data. The format of the data, readiness to receive or send, error detection and error handling are only a few of the operations defined in a protocol.

Remote Echo

The display of data that has been sent to the remote computer and returned to the local screen. Remote echoing is optional.

Serial Transmission

The transfer of data characters one bit at a time, sequentially, using a single electrical path. ➤ See **Parallel Transmission**.

Start/Stop Bits

The signaling bits attached to a character before the character is transmitted during **Asynchronous Transmission**.

Synchronous Transmission

A form of transmission in which data bits are sent at regular, fixed intervals. Because the timing is uniform, no Start or Stop bits are required.

TELPAC

A telecommunications software package produced by U.S. Robotics. TELPAC provides the basic software requirements for using a modem/microcomputer for data communications and offers a number of enhancements as well, including telephone directory storage and automatic execution of calls at user-defined times.

Terminal Mode

An operational mode required for microcomputers to transmit data. In Terminal mode, the computer acts as if it were a standard terminal rather than a data processor. Characters typed at the keyboard are sent directly to the modem and then over the phone lines.

Transmission Rate

Same as **Bit Rate**.

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